October, 1937

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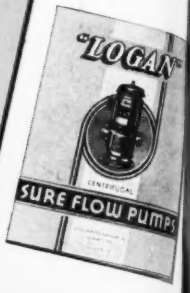

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Volume 10 OCTOBER, 1937 Number 5

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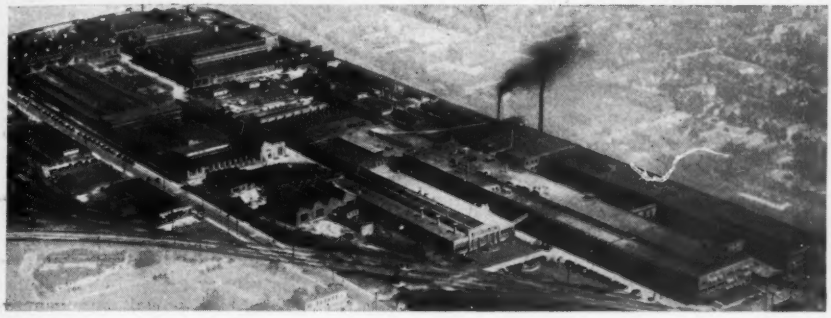


Production Operations on Servel Refrigerating Equipment

Well-Planned Operations and Efficient Equipment Make it Possible to Market a Quality Product at Nominal Cost.

BY HOWARD CAMPBELL

MECHANICAL refrigeration, originally regarded as a luxury, is fast becoming an important necessity in every-day life. The small units which were developed to provide an individual ice-plant for each householder have been adapted to the cooling of building interiors and no modern store, theatre, or office building is considered properly equipped unless it is air-conditioned. The possibility of air conditioning is considered in all the newest designs for dwellings, and the architect draws his plans accordingly.

This development and rapid growth in the use of mechanical refrigeration can be credited to the "machine

age"—to the precision production equipment which makes it possible to work to a ten-thousandth of an inch

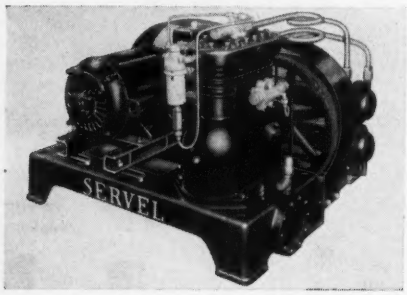


Fig. 1—Servel Air Conditioning Unit, made in sizes 1/6 to 1/20 h.p.

while producing parts at a high rate of speed and thus reducing the cost to a point low enough to make mechanical refrigeration a commercial possibility.

Among the plants which are outstanding for their careful engineering and fine workmanship on refrigerating units is the plant of Servel, Inc., at Evansville, Indiana. This article presents some of the more interesting operations in the building of Servel Refrigerating Units. A Servel unit of the smaller type is shown in Fig. 1.

The illustration Fig. 2 shows the finishing of both sides of the base plate for a compressor unit. While not particularly a "precision" operation, this operation illustrates the point of "speed" in manufacturing. Only enough stock is removed to finish the surface —usually approximately 1/64 in.— and the operation is performed on a diamond grinder. The piece is held on a magnetic chuck which is set vertically, as shown. No clamps are necessary; thus the piece can be chucked, finished, and removed at a rate of approximately 60 pieces per hour.

The crankcase, in which the cylinder bores are located, is machined on top and bottom first by milling, after which these surfaces are finished by grinding in the Blanchard surface grinder shown in Fig. 3. Sixteen pieces are finished at a time, held on a magnetic chuck as shown, and approximately 0.015 in. of stock is removed from each surface. The time required to finish the 16 pieces is from 15 to 20 minutes and the dimension from the top to the bottom of the piece is held within 0.002 inch.

Pistons are ground in the same manner on this same machine. Some 45 different jobs are finished in this machine.

Piston holes in cylinders for one of the small size air conditioning units are drilled, bored, reamed and counterbored in the set of three Baker

Fig. 2—The base plate for the compressor unit is finished on both sides by grinding in this Diamond surface grinder. The workpiece is held in position by a magnetic chuck, eliminating necessity of clamping.

vertical drilling machines illustrated in Fig. 4. The machine tables are so aligned that they can support a track upon which ride the three jigs, each of which is equipped with grooved wheels. This principle of construction makes it possible to adjust the jig back and forth so that

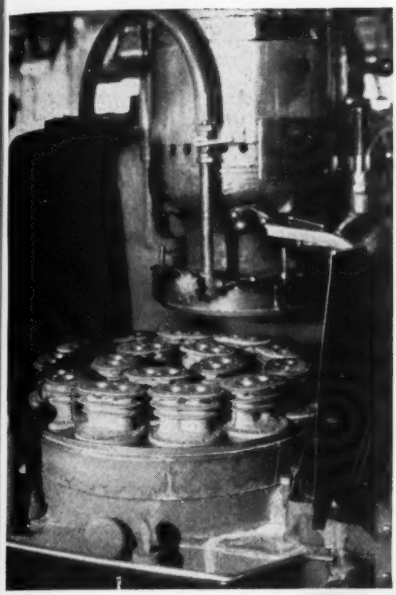


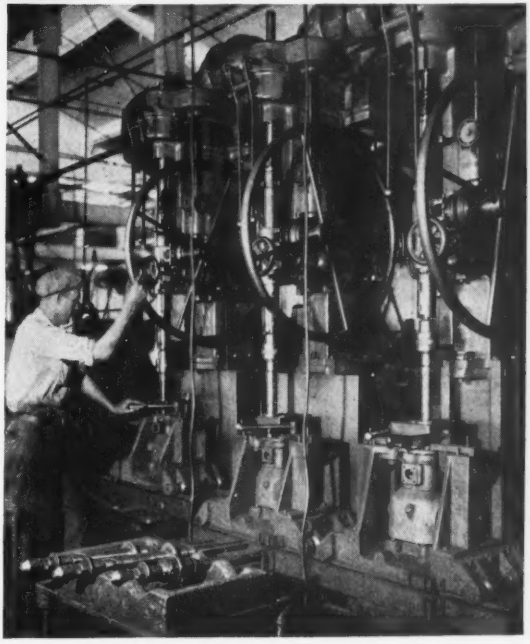
Fig. 3—(Above)—The top and bottom surfaces of the crankcase are finished by grinding in this Blanchard surface grinder. Fig. 4—(Right)—Three Baker drilling machines are kept in continuous operation, boring and reaming the piston holes in the cylinders.

both cylinder holes can be machined.

The jigs are not moved from one spindle to another, however; instead, each piece is finished in its own machine, the tools being equipped with Magic chucks so that the tools can be changed without stopping the machines. It has been found quicker to change tools than to change machines and the operations are started and completed consecutively so that the operator simply goes from one machine to the next changing the tools until each cylinder in turn is finished and the jigs have been reloaded with unfinished pieces.

By handling the job in the manner described above it is possible to machine three different sizes of cylinders at one time, and it is usual for two different sizes to be in process simultaneously.

After boring, the cylinders are finished to size by honing in the Hutto grinding machine shown in Fig. 5. A Hutto four-stone hone is used, all cylinders being rough honed first and then finished. The stones in the roughing hone are slightly rougher than those used in the finishing hone, and the hones are changed between operations. The cylinder shown in process is for a three-cylinder compressor. The bore on this type of cyl-



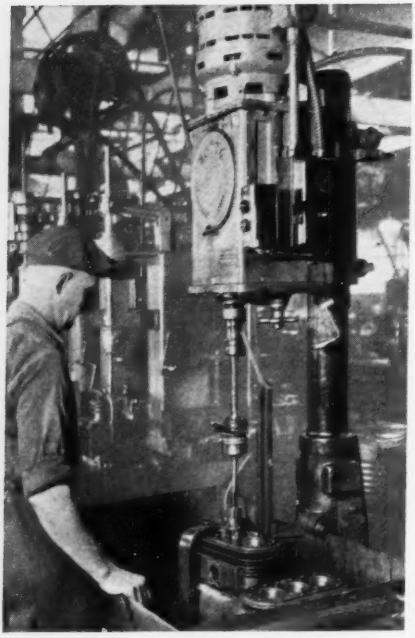


Fig. 5—Here the cylinder for a triple-cylinder air conditioning unit is being finished to size by honing in a Hutto honing machine.

inder is 2.375-in. diameter with a limit of plus or minus 0.0005 inch.

A typical example of a modern precision machine tool is illustrated in Fig. 6, where a Heald "Red Head" Bore-Matic diamond boring machine is being used to bore the crankshaft bearing holes in a compressor body. The tools are of Carboloy, and the spindles in which they are held are operating at a speed of 2810 r.p.m. Only one bearing is bored at a time, the piece being then reversed so that the other bearing can be bored. Upon the boring of the second bearing, a pilot is used to insure that the bearing holes will be in perfect alignment. From 0.012 to 0.013 in. of stock is removed from each hole, the finish diameter being held to a limit of plus or minus 0.00025 in. Production on this operation is approximately 60 pieces per hour.

Each refrigeration or air conditioning unit is powered by an individual electric motor from which the power is transmitted to the compressor by means of V-belts. The pulley upon which the V-belt operates must be machined very accurately in order to obtain the highest possible tension with the lowest possible strain between the two shafts. A pulley for an air conditioning compressor unit can be seen in Fig. 7 in process of having five belt grooves machined in it. The machine is a Warner & Swasey No. 2A turret lathe, equipped with a turret tool holder which holds several different kinds of tools for the machining of the pulley. The pulley is held in a chuck and is steadied by a bull center in the turret.

Another example of the modern equipment which makes possible extreme accuracy at high speed is the Cincinnati centerless grinding machine shown in Fig. 8. In this case, the machine is being used for the

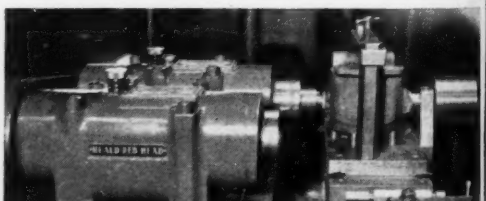


Fig. 6—Crankshaft bearing holes in the compressor bodies are bored to size in this Heald "Bore-Matic" diamond boring machine.

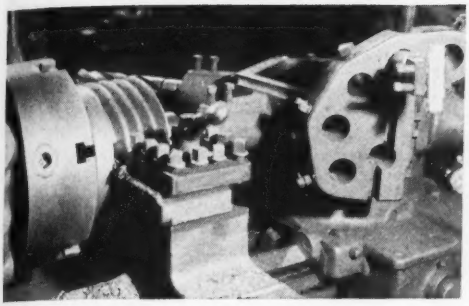


Fig. 7—Turning the belt grooves in a compressor pulley. With this Warner & Swasey turret lathe the pulley is turned, bored and faced simultaneously.

grinding of eccentric shafts for an air conditioning compressor unit. The shafts are passed through the machine three times; in the first pass the stock is roughed down to within 0.003 in., in the second pass the shaft is finished to within 0.0005 in., and in the third pass it is finished to within plus or minus 0.0002 in. of drawing size. A mirror finish is obtained and the shafts are finished at a rate of 50 per hour on the two roughing operations and 100 per hour on the finishing operation. All straight shafts, bushings, and other small cylindrical parts are finished by this method.

The illustration Fig. 9 shows how the "fins" are pressed into place on the tubes of the evaporator. The machine used for this operation was originally a Bausch multiple spindle drill which has been converted into a hydraulic press. Tapered plugs are set into the upper ends of the tubes so that the fins can easily be located and forced into position. The fins on the evaporator shown in the illustration are 6x13½ in. and are of 22 gauge metal. Each fin has 21 holes to accommodate the 21 ⅝-in. copper tubes with which they are to be assembled.

The fins are spaced 5/16 in. apart, which is accomplished by means of the mechanism on the side of the press, shown in Fig. 10. Upon locating the fin in the proper position over the tubes, the operator pushes a button which starts the operation cycle of the press. The head moves down a predetermined distance and then back up again to the stopping point. As it reaches a point near the top of its cycle, however, the arm A strikes the collar B, which is anchored to the shaft C. At the upper end of shaft C is a rack which engages the teeth on a gear upon a shaft which is also the shaft for the bevel gear D. This bevel gear rotates a mating gear on the upper end of the shaft E, which is connected with the mechanism by which the table is

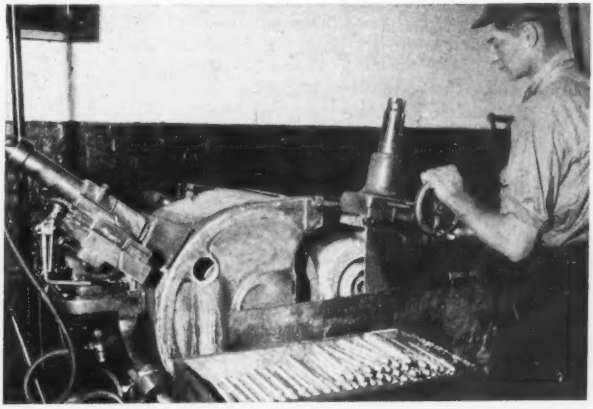


Fig. 8—Shafts are finished to size within 0.0002 in. in this Cincinnati centerless grinding machine.

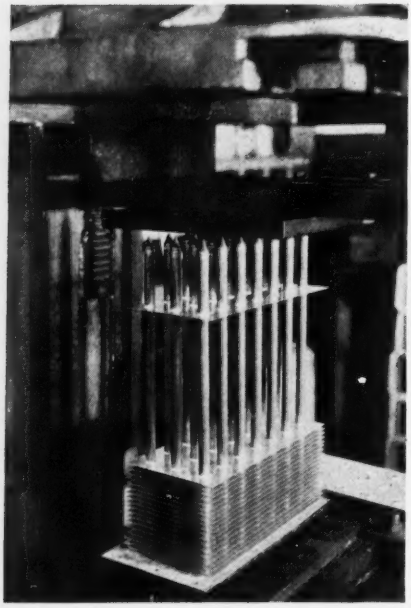
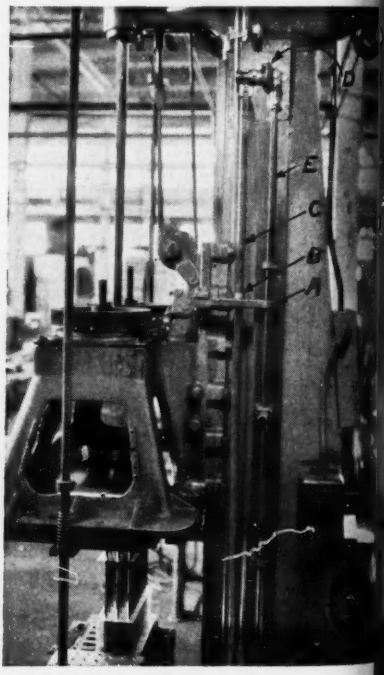


Fig. 9—Assembling the fins to the tubes of an evaporator unit. The press was rebuilt by Servel from a multiple drilling machine.

raised. Thus as shaft **C** is forced upward, gear **D** is rotated, and the motion is imparted to the vertical shaft **E**, resulting in a downward movement of the table. The extent to which the table is moved depends upon the setting of collar **B**. Thus, at each movement of the press, the table is lowered the desired distance so that a predetermined dimension is maintained between the fins. All the operator has to do is to place the fin in position over the tapered plugs in the upper ends of the tubes and then depress the foot-pedal which engages the clutch and starts the operation-cycle.

Each compressor unit is tested for leaks after assembling by attaching an air hose to the unit and immersing the unit in a tank of water. As each compressor in turn is moved along on the roller conveyor toward th water test tank, it is picked up b means of an overhead air hoist, swun into position over the tank, and then lowered into the tank, as show in Fig. 11. When completely im mersed, dry air at 250 lbs. pressur is turned on and if there are an leaks, the bubbles will immediatel be visible. If upon careful inspection no air bubbles can be seen, the uni is set back on the conveyor and passe on to be dried and finished for ship ment. If there are evidences of leak age, the unit is completely disas sembled, each individual part is thor oughly inspected, and the defect i remedied by repairing or by discard ing it altogether and substituting a new part.

Fig. 10—This view shows the mechanism b which the spacing is obtained between th evaporator fins.



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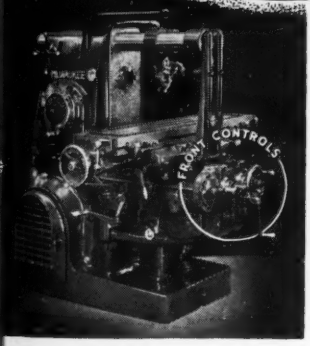

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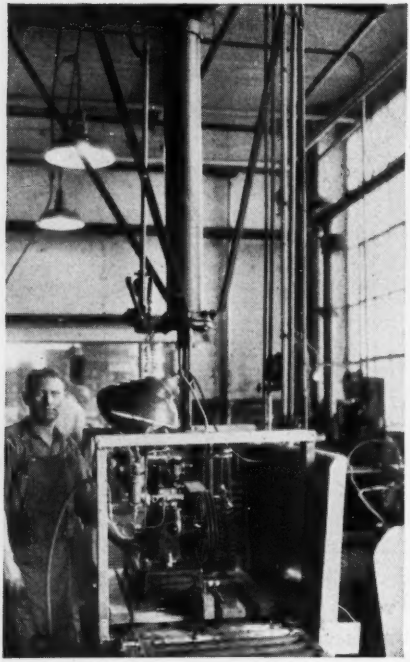

Fig. 11—Each compressor unit is tested for leaks after assembling by attaching an air hose to the unit and immersing the unit in a tank of water. No bubbles—no leaks.

No Servel unit is allowed to leave the plant until it has been "run-in" for a sufficient length of time to prove that it is built to the specifications set up by the engineering department and will function properly in every-day use.

Control of Electric Motors. By P. B. Harwood. 390 pages. 188 illustrations. John Wiley & Sons., Inc., New York, N. Y. $4.50.

The author describes the features of motors of all types and explains how their characteristics are used for control purposes. The descriptions of apparatus cover fully the design, construction and functions of the elements making up the devices. Both direct-current and alternating-current motors are discussed and classified by types, as are the appropriate controllers used with each style. Pilot devices and accessory switches of various kinds are covered. Brakes and methods of mounting them are treated briefly. A chapter on wiring diagrams with a list of definitions and graphical symbols with pertinent notes and examples is included. Resistors and resistor design are dealt with in full, as is the subject of the construction of control apparatus.

The book appropriately illustrates the subject matter. This volume can be of much benefit to all engineers and designers whose field of work includes the use of electrical motors for operating and driving machinery.

Stainless Working Methods Book. A new technical publication by Ludlum Steel Co., Watervliet, N. Y., entitled "The Working of Silcrome Stainless Steel," links up, in a novel way, detailed instructions on methods of fabricating Ludlum Stainless with information as to to the grades of tool steel best suited to each operation.

This factual data book has been prepared for the use of engineers, designers, and other technical men interested in practical working methods, to guide them in using Silcrome to greatest advantage. It contains practical advice on all the usual metal working operations, such as sawing, drilling, milling, threading, tapping; also on hot upsetting and forging, shearing, drawing, punching, spinning, brazing, soldering, welding, and the like. In addition, the book contains information on the proper selection, heat treatment, etc., of the tool steels for the various operations.

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Dumore No. 12 "Chief" Lathe Grinder is described and illustrated in a bulletin now being distributed by The Dumore Company, Racine, Wis. Outstanding features of the grinder are discussed and photographs show several installations of the "Chief". Copy free upon request.

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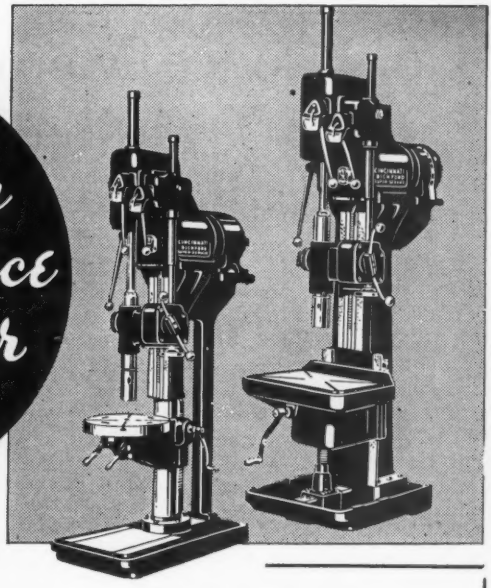

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SUPER SERVICE UPRIGHTS

Conference Method of Foreman Training at Crosley Radio Corporation

By J. M. Baker
Personnel Director, Crosley Radio Corporation

POWEL CROSLEY, JR., president of the corporation which bears his name, has said "If a man cannot or will not learn to mesh in his part of the job with the organization as a unit, he simply does not belong. His ability and his experience are of no value whatever unless he knows what it means to cooperate willingly." Lack of cooperation is sometimes a question of disposition or state of mind of the individual. Cooperation, on the other hand, is more likely to be a matter of knowing how, of training, and of understanding how an organization works as a unit, whether its members be spread over a manufacturing plant or over a continent.

The function of any foreman is to so supervise his department as to enable his people to do their work in the easiest and best way and to coordinate their efforts properly with related functions. This can be done after a fashion in a hit-and-miss manner, but too many inaccuracies can creep in. With this thought in mind, the Crosley Radio Corporation undertook, about a year and a half ago, a course of training for its foremen and department heads. The details of the training course were worked out with the help of the plant superintendents and in cooperation with the University of Cincinnati.

After considerable investigation as to the methods in use in other plants and other industries, it was decided that the conference method should be adopted, inasmuch as this method appeared to enlist and hold the interest of the men to a greater degree than the classroom or lecture methods. Briefly, what we aimed to do was to delineate the important features of the foreman's job and to encourage practical discussion of the foreman's supervisory, managerial, and training responsibilities. No attempt was made to present a cut-and-dried program of topics for discussion; rather, it was felt that the discussions should be based on the problems and experiences of the foremen themselves.

As finally worked out, the training course comprised 16 conferences. The meetings were conducted under the supervision of the plant Personnel Director and were held in one of the studios at the plant once a week from 4 to 6 o'clock P. M. The Personnel Director selected the leader for each conference, the plant executives taking turns in conducting the meetings.

At the first meeting it was made clear that the conference leader was not expected to lecture the foremen on how to do their work, but would simply act as the presiding officer and leader of the discussions. The objectives of these discussions were outlined as follows:

1. To develop and equip experienced foremen to conduct foremanship con-

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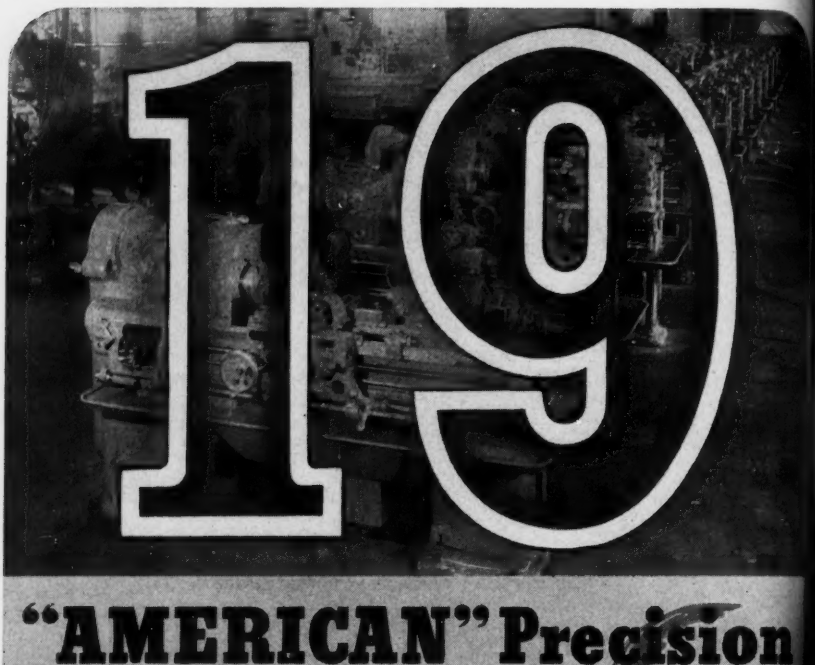

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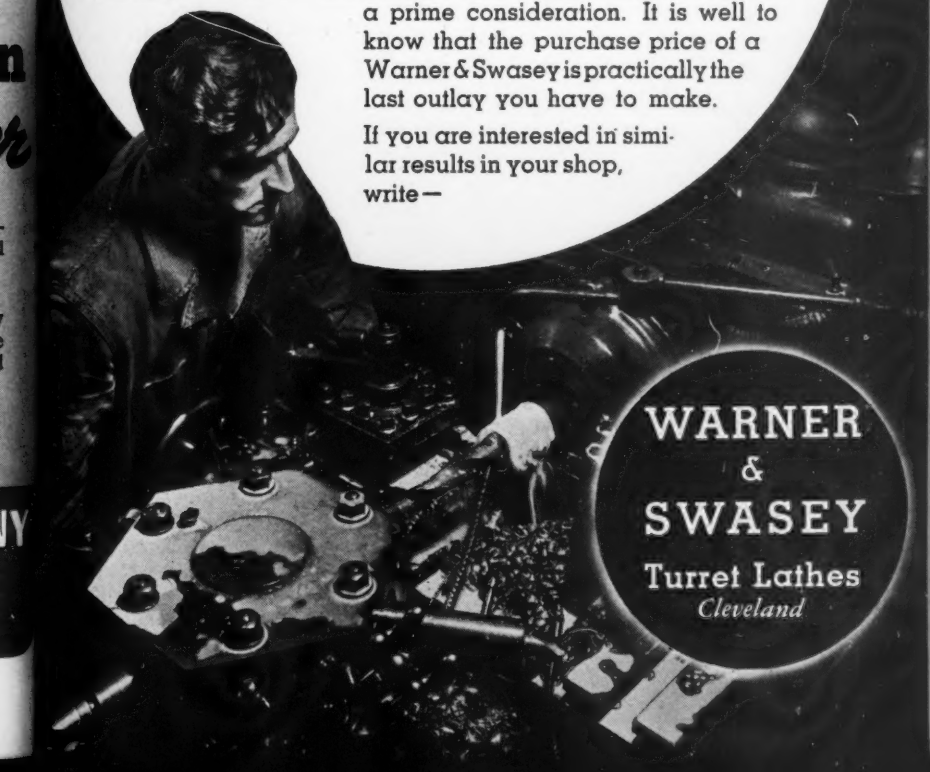


WARNER & SWASEY
Turret Lathes
Cleveland

ferences in their respective divisions by developing the native ability of the individuals.

2. To provide a forum where foremen may get together and express their opinions freely regarding suggestions for solving definite problems which confront them in their daily work.

3. To develop and promote a better understanding and relationship between the foreman and his men, the foreman and his fellow foremen, and the foreman and his company.

4. To encourage analytical, constructive thinking that will help the foremen to develop scientific methods of analyzing their difficulties and solving the problems that interfere with the efficient functioning of their departments.

It was pointed out that the average foreman is promoted to his position because he is a superior worker in his own department and understands all of the operations and processes. It is possible, however, that he has had little or no training with respect to what might be called the human factor—handling workmen and "getting along with people." Consequently he is faced with a great many brand-new problems such as promoting morale, developing co-operation, restricting labor turnover, instructing new and older workers, and representing workmen as well as management.

The latter part of the first session was given over to a preliminary discussion of the responsibilities of a foreman, and the meeting closed with the assignment of three topics, under the general heading "Cooperation," for practice conferences to be conducted by three foremen who are named as leaders for the subsequent meetings.

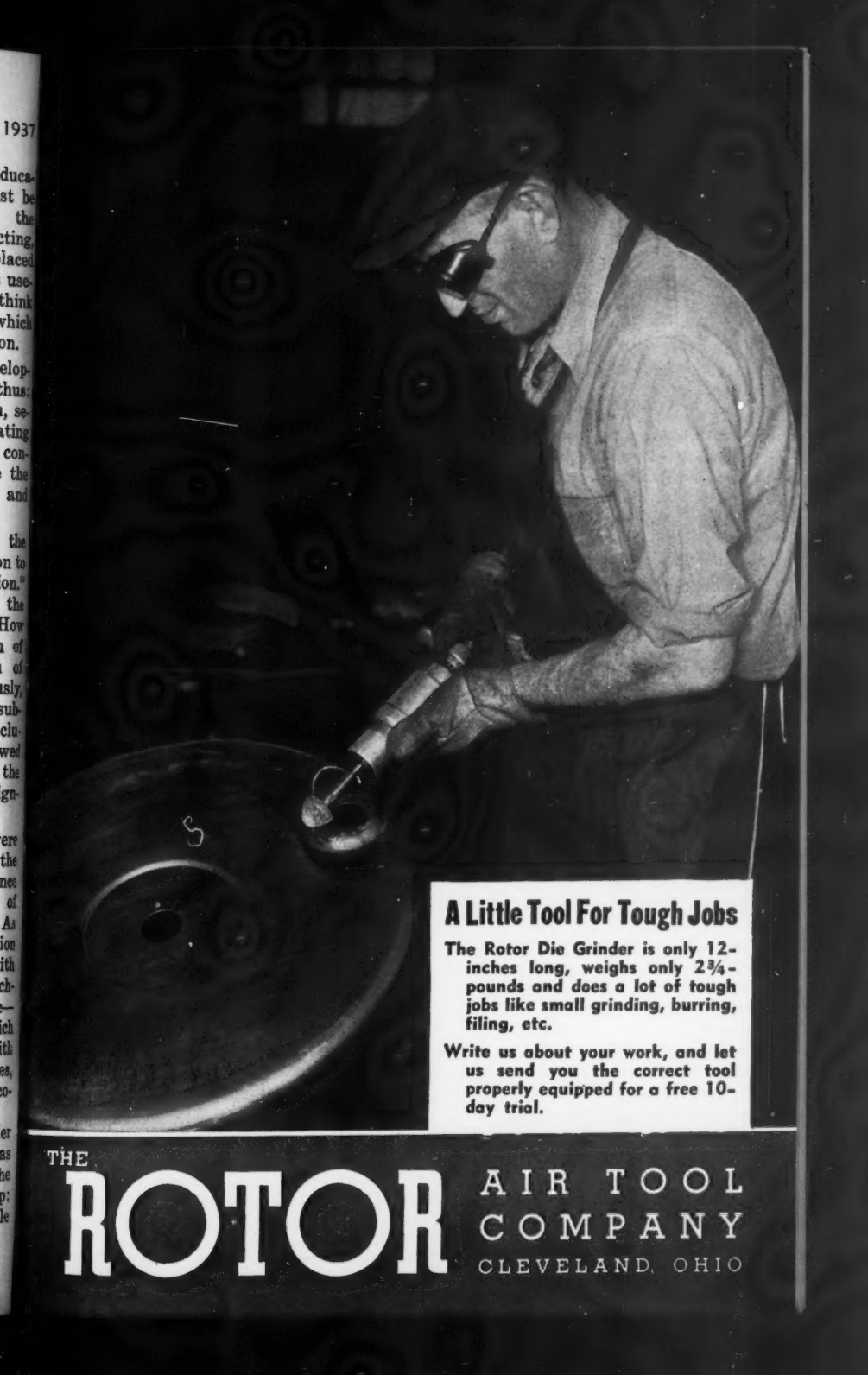
At the next meeting the conference leader reviewed the work accomplished at the first meeting. Then he presented, briefly, the types of educational procedure which could best be used by foremen, classifying the methods as informing, instructing, and conferring. Emphasis was placed on the conference method and its usefulness in helping foremen to think clearly through a problem for which there may be no standard solution.

The various steps in the development of the plan were outlined thus: preparation, securing information, selecting functioning data, evaluating functioning data, arriving at a conclusion, planning means to make the conclusion effective in practice, and carrying out the plan.

With that outline as a guide, the designated foreman was called upon to lead a conference on "Cooperation." This subject was expanded by the group under four headings: How Foremen Cooperate, Classification of Data, Evaluation, and Definition of Cooperation at Crosley's. Obviously, a general discussion on such a subject is enlightening to all. In conclusion, the conference leader reviewed the handling of the conference by the designated foreman and made assignments for the next two meetings.

The three meetings following were devoted to a combination of the theory and technique of conference practice and the practical work of conferring on everyday matters. As an illustration, at the third session the conference leader discussed with the group two fundamental techniques in the conference procedure—objectives and questions—after which the foreman leader attempted, with the assistance of the other conferees, to analyze the causes of lack of cooperation.

These causes were listed under seven headings, each of which was amplified and developed out of the practical experience of the group: General Characteristics of People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Who Do Not Cooperate, Reasons Why Foremen Do Not Cooperate with Subordinates, How to Improve Cooperation with Subordinates, Reasons Why Foremen Do Not Cooperate with Other Foremen, How to Improve Cooperation Between Foremen, Reasons Why Foremen Do Not Always Cooperate with Superiors, and How To Improve Cooperation with Superiors. The group as a whole participated in the general discussion.

While a certain amount of the instruction was of the theoretical type, every effort was made to keep the meetings on a practical plane. For instance, at the fourth meeting, the conference leader presented this specific case:

A foreman, walking through his department, noticed that a belt was badly worn. He wrote a requisition for a necessary replacement and ordered a workman to make the repairs. The foreman noticed that the man was not familiar with the job, so he instructed and checked him on the work.

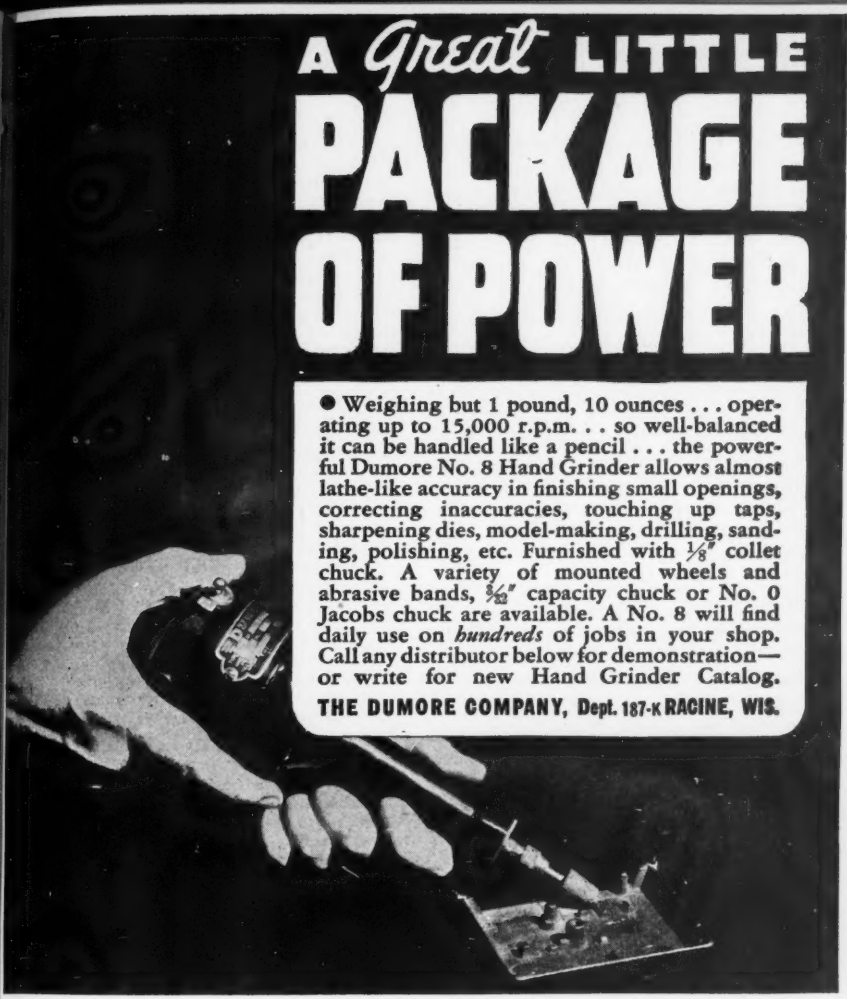
An analysis of this incident made by the group showed that the foreman had performed three functions; supervisory, managerial, and instructive. In his supervisory capacity he had observed the worn belt, analyzed the need for repair, and had checked the finished job. The managerial function consisted of writing a requisition for the material, selecting an available man, and assigning him to the job. As an instructor he noted the inexperience of the worker, instructed the man, and checked the finished work. This was only one of a number of similar cases which were presented for analysis and discussion.

One of the best discussions was that on the handling of difficult types of employees. Under this classification belong those employees who are dissatisfied, indifferent, radical, wasteful, troublesome, and disloyal. The conference centered upon methods of recognizing these individuals and the application of remedial measures. For instance, one conference was devoted to the "Radical Type of Employee," the subject being divided into the following classifications for purposes of discussion: Characteristics of a Radical Employee; Definition of a Radical Employee; Suggested Remedial Measures; Suggested Remedial Steps. In the conference devoted to the discussion of "The Wasteful Employee," the discussion took up the following topics in turn: How to Recognize a Wasteful Employee; Classification of the 19 Points Brought Out in the Discussion; Suggested Remedial Measures; Suggested Remedial Steps.

Among other practical problems taken up and discussed by the group during the remainder of the course were subjects related to accident prevention and the accident-prone worker, fire control, waste of material, reduction of scrap, selection and development of young men, human engineering, a square deal for each employee, job security, waste that can be prevented by the foremen, the three functions of a foreman, how and where time is wasted, and so on.

When the conference was started, the group included sixty-five foremen, this number being added to from time to time until the group numbered one hundred twenty-five. When it reached this size the group was divided into four groups of twenty-five to thirty men each, so that the participation could be more general.

At the close of the series it was pointed out that each foreman derived benefit from the proceedings in proportion to what he had put into them, and also that those who did not join in had had the advantage of the other fellows' ideas without contributing anything. It was noted with satisfac-



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tion that the interest of the men held throughout the course because they had chosen their own subjects for discussion and because they had drawn from their own practical experience in presenting solutions for the problems under consideration.

There is no question but that, however good the material, a foreman needs a certain amount of training for foremanship just as he needs it for any other position of leadership. The newly-appointed foreman may have been an excellent mechanic, and he may have the qualities necessary to becoming a good foreman, but it should be remembered that he had to be trained for his mechanical job, and he should have certain definite training for his job of directing and supervising the other people in his department.

There are many expert workmen who lack the peculiar qualities necessary for successful leadership, and there are many natural leaders who, for one reason or another, are not expert workmen. It is not unusual to find a man who cannot be interested in detail work and who is therefore unhappy at it, but who is excellent at planning, directing, and leading. However, it is rare that a new foreman understands what is expected of him so well that training is unnecessary. He may have pre-conceived notions regarding foremanship which are contrary to good practice, or which are not in accord with company policies; consequently he needs proper instruction before he has had an opportunity to make too many errors.

Training for leadership is definitely necessary, and the conference method appears to fill the need in a highly satisfactory manner. It is hoped that the information regarding Crosley's experience which has been presented here will be of some value to others who are considering this matter.

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High Speed Steel

In this, the third and last article of the series, the author discusses the hardenability of high speed steels and presents the results of a series of tests made with steels of various analyses under a varying range of conditions.

By J. P. Gill
Chief Metallurgist, Vanadium-Alloys Steel Company, Latrobe, Pa.

WHEN any of the high speed steels are heated to the temperatures generally recommended for hardening, a solution of the carbon and alloys takes place, dependent upon the temperature and length of time the steel is held at that temperature. With the temperatures generally recommended there will appear a structure having a well-defined polyhedral grain when the temperature has been held for several minutes. The growth of this grain will depend on the time and temperature, and upon the size of such grain will depend considerable of the physical properties of the steel such as plasticity, length changes, wear, and so on.

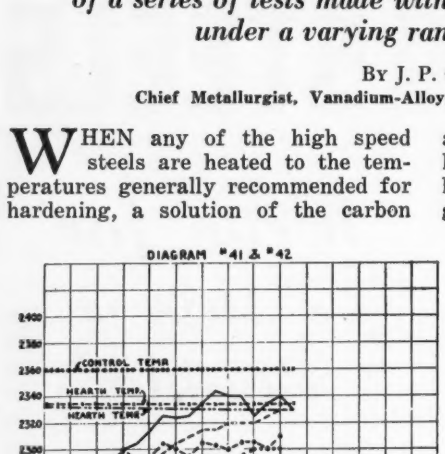


Fig. 8—Chart showing results obtained by heating two identical specimens (Nos. 41 and 42) in different atmospheres.

Presented herewith are a number of micrographs made from samples of an 18-4-1 high speed steel 1 in. in diameter after being held in a semimuffle gas-fired furnace at temperatures of 2350 deg. F. for the time specified and oil quenched but not drawn. The structure of the micrographs is usually considered of the austenitic type, but by X-ray and diffraction magnetic tests it has been proven that this structure is made up of both austenite and martensite, probably about 25 per cent austenite being included in the structures shown.

It is important, in the hardening of fine edge tools, to heat them in such a manner that the fine cutting edges will not be damaged. For many years it has been known that furnace atmospheres materially affect the surface of high speed steel when heating for hardening. Furnaces with controlled atmospheres have been developed primarily to produce a better surface on hardened tools. It has also been

noted that in certain atmospheres the steel could be held much longer at the hardening temperature without material grain growth. Tour, and Phillips and Weldon published papers on this phenomenon. Their deductions were practically the same, namely, that the gases surrounding the steel during heating for hardening did in fact materially affect the grain size as well as the temperature at which the carbide segregate would fuse.

About four years ago the writer, upon making an investigation of this puzzling phenomenon, at first came to the same conclusion as the investigators mentioned, but when attempting to check his results in a different furnace and with gases synthetically mixed, obtained different results. Further investigations led to the conclusions that the gases surrounding the steel were materially affecting the temperature of the steel as well as the time of heating. A number of investigators have taken exception to these conclusions and the writer again repeated his experiments to show that, by varying the composition of the gas, a change could be made in the rate of heating.

The first group of samples was treated in a controlled atmosphere furnace. The samples were taken from the same bar of 0.70 per cent carbon, 18-4-1 high speed steel. The samples were machined by removing one-eighth inch of surface to give a cylindrical bar 2 inches in diameter by 2 inches long and drilling a 11/32-inch diameter hole longitudinally in the center to a depth of 1¼ inch. Three thermocouples were used; one inside the specimen and another flat against the surface of the specimen; the third was the furnace control couple, located about 6 inches above the hearth. The temperature of the hearth was taken immediately before placing the specimen in the furnace and immediately after its removal. New thermocouples were used for each specimen, and temperature readings were taken every 30 seconds. All the specimens were preheated alike

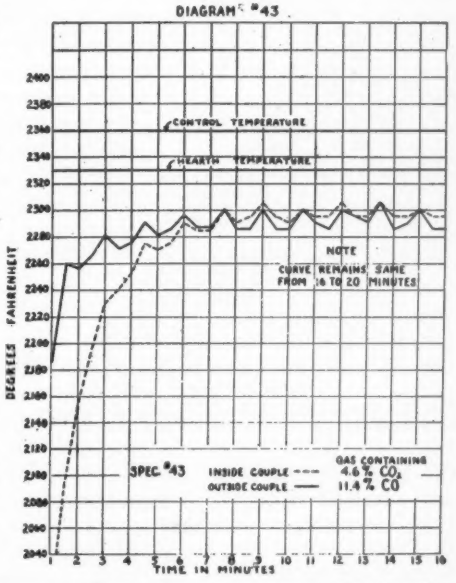


Fig. 9—Chart showing result obtained by heating an identical specimen (No. 43) in the same atmosphere as used for specimen No. 41, but holding it for 20 minutes.

in the same furnace and for the same period of time, which was 35 minutes at 1550 degrees F. (840 degrees C.).

For the first two specimens, indicated as Nos. 41 and 42, the temperature control was set at 2360 degrees F. (1280 degrees C.). An atmosphere containing the greater percentage of per cent CO was used for specimen 41 and an atmosphere of 11.0 per cent CO_2 and 1.0 per cent CO was used for specimen 42. The results are presented in Fig. 8 and definitely show that the specimen heated in the gas containing the greater percentage of

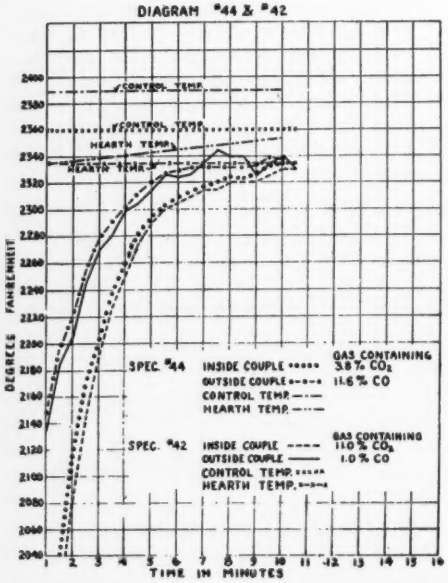


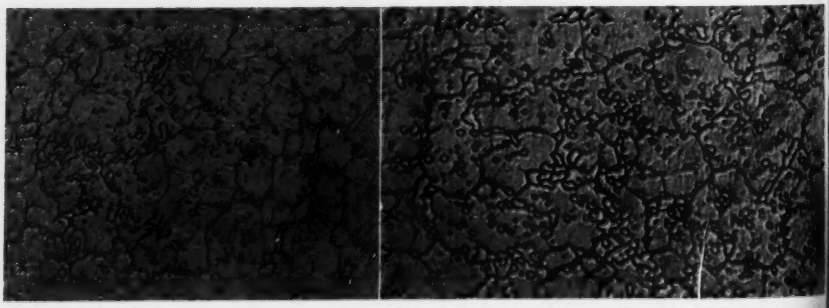
Fig. 10—Chart showing a comparison of temperature readings for specimens No. 42 and No. 44.

CO_2 rose in temperature more rapidly and attained a higher temperature. It is interesting to note that specimen 41 never reached the hearth temperature, while specimen 42 did.

From this diagram it appeared that possibly specimen 41 had not been held a sufficient length of time to reach the hearth temperature, so specimen 43 was heated in the same atmosphere as specimen 41 and held for 20 minutes with the results shown in Fig. 9; again the specimen did not become as hot as the hearth. By experiment a temperature was selected so that specimen 44 could be heated at the same rate and to the same temperature in a gas containing 3.8 per cent CO_2 and 11.6 per cent CO as specimen 42, which was heated in gas containing 11.0 per cent CO_2 and 1.0 per cent CO. It was found that the temperature control should be set at 2390 degrees Fahr. (1305 degrees C.) to obtain this heating rate.

Figure 10 shows a comparison of the temperature reading for specimen 42 as compared with specimen 44. Photomicrographs Figs. 11 and 12 taken half way between center and outside of these specimens, show no noticeable difference in grain size and the hardness of the two specimens was exactly the same, namely, Rockwell 66 C. Similar experiments were made using the same furnace with about the same atmosphere but varying the temperature, and in every instance the results were similar to those given.

It must not be inferred from these experiments that the amount of CO



Figs. 11 and 12—Photomicrographs of the structure half way between the center and the outside of specimens Nos. 42 and 44.

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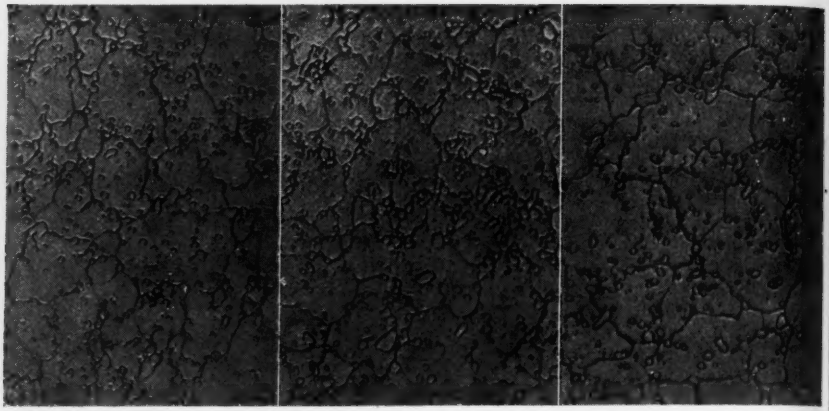


Figs. 13, 14, and 15—Photomicrographs of specimens Nos. 51, 52, and 53.

and Co_2 gases present alone determines the rate of heating. It is possible to keep the amount of CO and CO_2 gases constant and yet vary the rate of heating by a change in the composition of the remainder of the gas.

If atmospheres do affect grain size it should be noticeable with radically different atmospheres. To test this point, additional experiments were made with an entirely different experimental arrangement. A special quartz tube was used for the heating chamber and specimens were made from the same high speed steel bars, 1 inch diameter, machined to ¾ inch diameter by 1¼ inch long with a ¼ inch diameter hole drilled longitudinally in the center to a depth of ¾ inch.

Three platinum, platinum-rhodium thermocouples were used, one inside the specimen, one against the outside of the specimen and the third for the chamber temperature (which was taken immediately before the specimen was inserted and immediately after the specimen was removed, at the same location as the specimen), the thermocouples being calibrated and renewed when necessary for each specimen. Temperatures were recorded every 30 seconds.

Specimens, without preheating, were heated in pure CO, pure CO_2, and

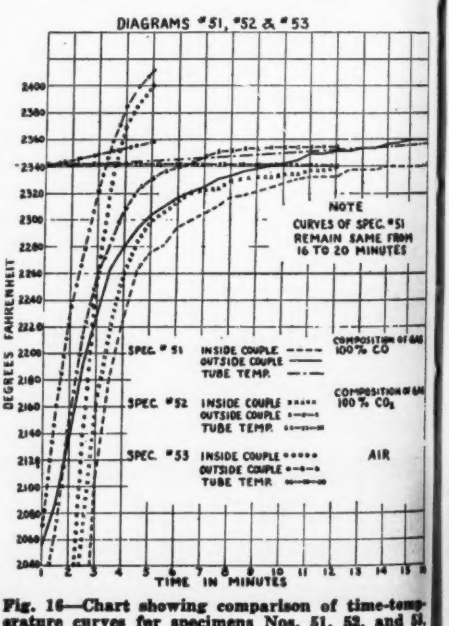
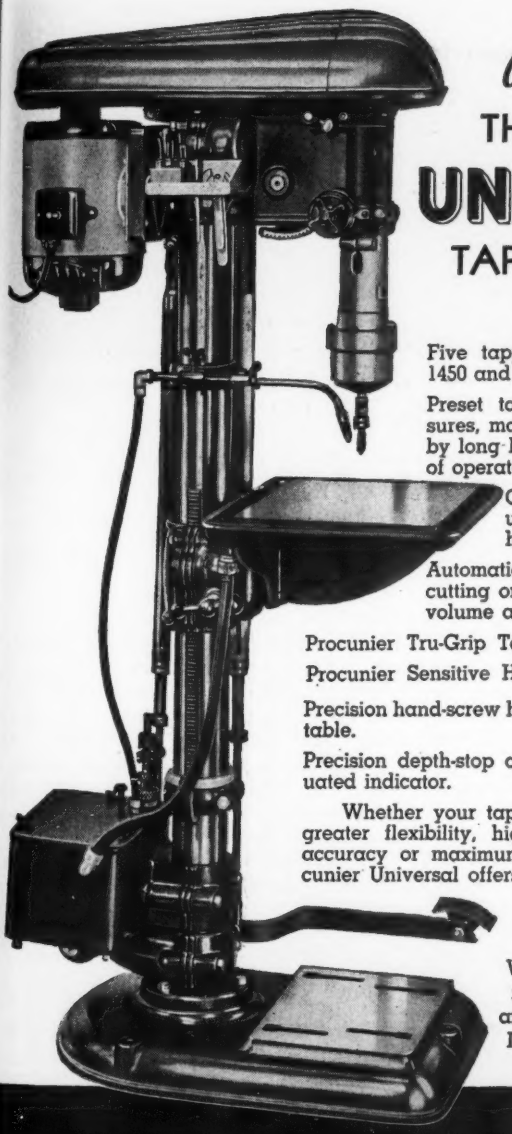


Fig. 16—Chart showing comparison of time-temperature curves for specimens Nos. 51, 52, and 53.



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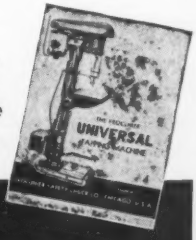

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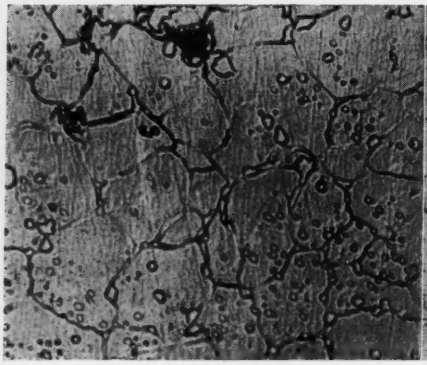


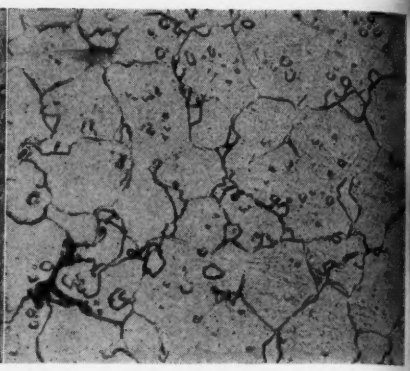
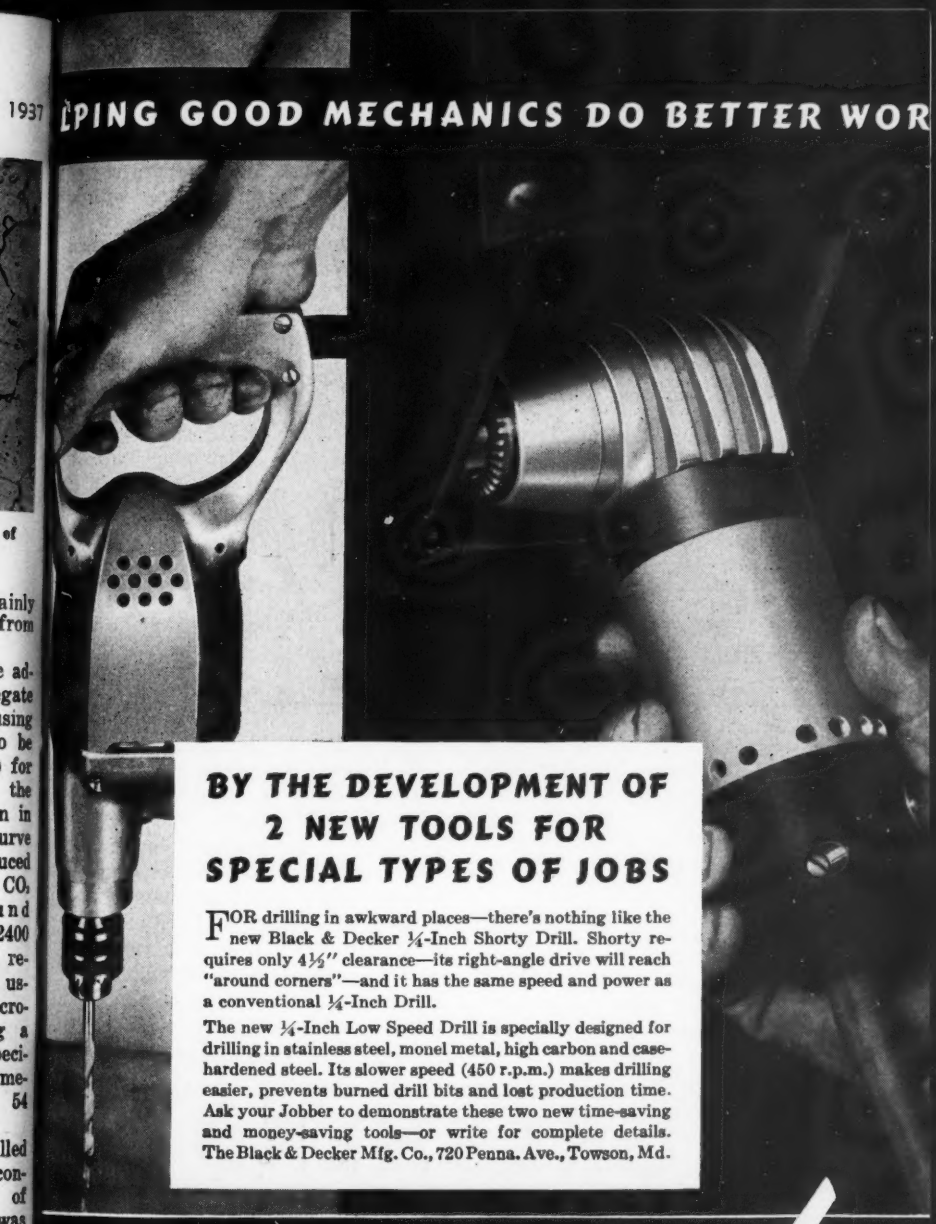


Fig. 17—Photomicrograph of structure of specimen No. 54. Fig. 18—Photomicrograph of structure of specimen No. 55.

air, and during the heating the gases were flowing slowly through the tube, each at the same rate. The tube was sufficiently long to preheat the gases, and tests were made to be certain that the gases were at the correct temperature at the position of the specimen. The tube temperature was originally set for 2340 degrees F. (1280 degrees C.) and the specimens were heated for various lengths of time in the respective gases. By comparing the grain size of the different specimens (listed as Nos. 51, 52 and 53) it was found that specimen 51 (Fig. 13) held for 20 minutes in CO gas, was similar in grain size to specimen 52 (Fig. 14) which was held 12 minutes in CO_2 gas, and to specimen 53 (Fig. 15), held 5 minutes in air but when the time-temperature curves of the specimens shown are compared as shown in Fig. 16, the reason is evident. The interior of specimen 51, which was heated in CO gas, did not reach the tube temperature in 20 minutes. The interior of specimen 52, heated in CO_2 gas, reached the tube temperature in 12 minutes and the surface of the specimen exceeded the tube temperature, while the specimen heated in air far exceeded the tube temperature both on the inside and outside. This specimen plainly shows self-heating or heating from oxidation.

The temperature and time were adjusted so that the carbide segregate would just begin to fuse when using pure CO gas; this was found to be 2425 degrees F. (1325 degrees C.) for 7½ minutes for specimen 54, the microstructure of which is shown in Fig. 17. The time-temperature curve of specimen 54 was then reproduced for specimen 55 but pure CO_2 gas was used. It was found that a tube temperature of 2400 degrees F. (1310 degrees C.) reproduced about the same curve, using CO_2 gas. Fig. 18 is a photomicrograph of specimen 55, showing a structure quite comparable to specimen 54, heated in CO gas. The time-temperature curves of specimens 54 and 55 are shown in Fig. 19.

Volume changes, sometimes called length changes, will depend to a considerable extent upon the size of the austenitic grain and again it was found that, by varying the atmosphere, considerable control could be had over length changes, but such control is really dependent upon the austenitic grain size, the atmosphere control simply being a part of the



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mechanics of varying the time and temperature. It can be stated that until something of the knowledge of the effect of atmosphere became known, it was impossible to compare the results obtained by one temperature and time in one furnace with those in another.

Plasticity and hot hardness will depend to a great extent upon the size of the austenitic grain. The plasticity is greater with a small grain and the hot hardness higher with a large grain. The diagram Fig. 20, showing the plasticity of an 18-4-1 high speed steel also shows that specimen 11T had a small grain, 12T an intermediate size grain and specimen 13T a large grain. In table 3 are given the hardness results at 1200 degrees Fahr. for an 18-4-1 high speed steel with different size grains. The grain size in the specimens was obtained by varying the time and temperature of treating, thus also resulting with a different alloy solution.

It was found that were the grain size obtained by treatments previous to the final hardening, the same relationship of the effect of grain size on plasticity was obtained but not with the results on hot hardness. Large-grained specimens showed no higher hot hardness than did small-grained specimens when the varying in grain size was obtained by preliminary treatments and the final treatments were the same, which is consistent with what the text books say on the effect of grain size on hardness.

TABLE 3

	C.	Si.	Mn.	W.	Cr.	Va.
Composition of Steel -	0.71	0.26	0.24	18.02	3.98	1.07

Size of Specimen - 1 c. m. dia. x 1 c. m. long - Ground Finish
Tested at - 1200 degrees Fahr.

Specimen Number	Grain Size	Average Brinell Hardness by Mutual Indentation	Grain Size obtained by
11	Small	342	Final Treatment
12	Medium	390	Final Treatment
13	Large	409	Final Treatment
40	Large	345	Preliminary Treatment

Final treatment of specimen 40 same as specimen 11

With the tungsten, molybdenum, chromium and vanadium constant in the non-cobalt steels, the hardness attainable is dependent upon the carbon content and with .70 per cent carbon, any one of the steels can be hardened to a hardness of Rockwell 64 or more. In any one of the types, the carbon is easily the most important of the elements that influence the maximum attainable hardness. Consequently, in making a comparison of

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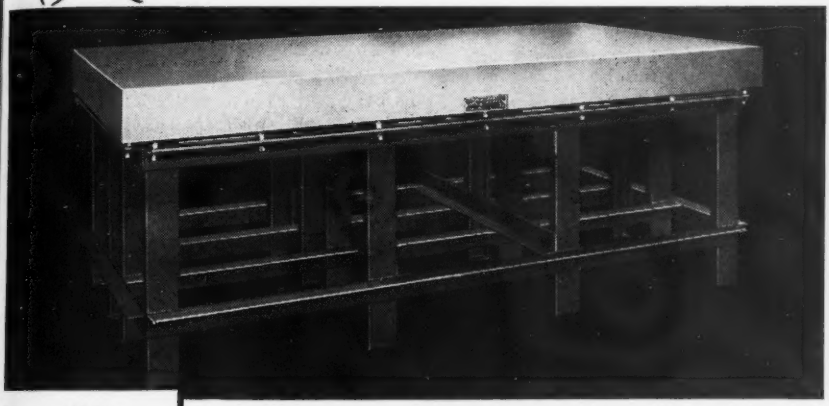

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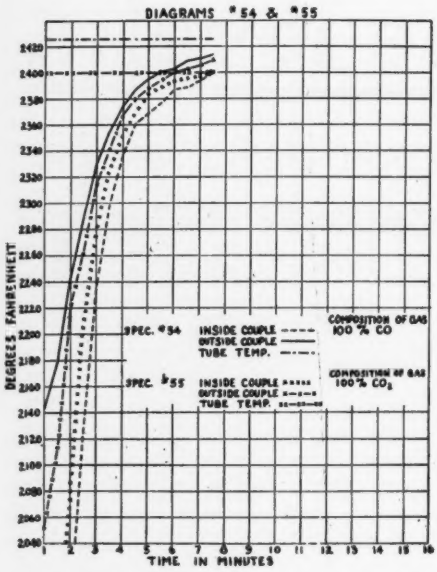

Fig. 19—Chart showing comparison of time-temperature curves for specimens Nos. 54 and 55.

either cutting or physical properties between different steels, it is most important that the comparison be based on steels of a comparable carbon content.

An examination of the structure of annealed high speed steel shown in Fig. 21 shows a large number of globules of the tungsten segregate, chiefly spheroidal in appearance. If we hold the steel at an elevated temperature, that is, something over about 1700 degrees F. for a prolonged length of time, these spheroids will have a tendency to become more crystalline in appearance so that they will appear angular rather than spheroidal, as shown in 22 and 23. When this happens, the maximum attainable hardness is noticeably less and steel of the same composition having the segregate in a spheroidal appearance that can be hardened to 65 Rockwell C may only be hardened to about 62 Rockwell C on a further crystallization of the segregate and using same treating procedure. Furthermore, unannealed high speed steel can often be hardened from 1 to 1½ points higher Rockwell C than can the same steel in the fully annealed condition, which is much the same as with other types of tool steels.

A second re-hardening of high speed steels from the usual hardening temperature will result in a so-called "fish scale" or flaky structure (Fig. 24) which is more easy of development with decrease

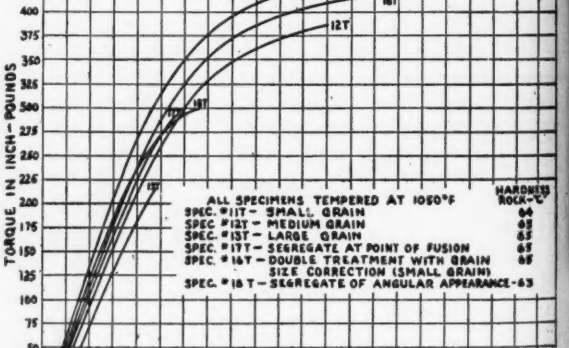
DIAGRAM #3
TORQUE IN INCH-POUNDS
DEFORMATION IN DEGREES
11T
16T
12T
13T
15T
ALL SPECIMENS TEMPERED AT 1050°F
HARDNESS ROCK-C
SPEC. #11T - SMALL GRAIN 64
SPEC. #12T - MEDIUM GRAIN 63
SPEC. #13T - LARGE GRAIN 63
SPEC. #17T - SEGREGATE AT POINT OF FUSION 65
SPEC. #16T - DOUBLE TREATMENT WITH GRAIN SIZE CORRECTION (SMALL GRAIN) 65
SPEC. #18T - SEGREGATE OF ANGULAR APPEARANCE-63

Fig. 20—Diagram illustrating plasticity of high speed steel and its relation to hot hardness and grain size.

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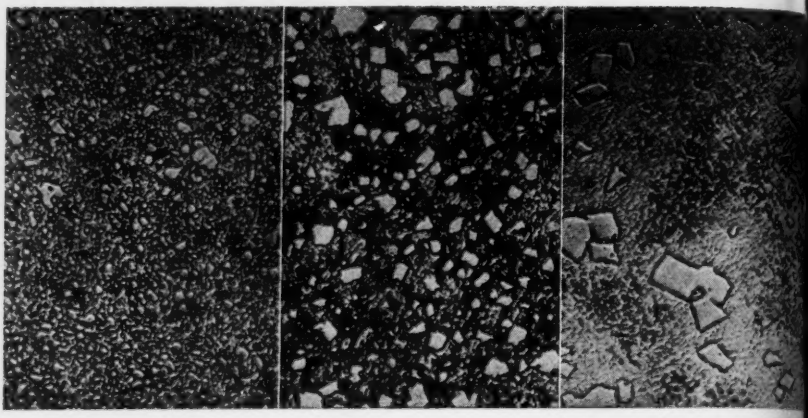

Fig. 21 (Left)—Photomicrograph showing structure of annealed high speed steel in which large number of globules of tungsten segregate, chiefly spheroidal in appearance, can be see Figs. 22 and 23 (Right)—Photomicrograph of the same annealed high speed steel as shown Fig. 21, but held at a temperature of over 1700 deg. F. for a prolonged length of time.

in the tungsten content in the steel. The same structure may be brought about on the initial hardening of a steel which has been highly cold-worked without sufficient annealings between passes. Such a structure in a tool may result in excellent cutting properties but causes brittleness and usually chipping. It should be avoided and can be prevented.

Any of the steels may be satisfactorily air hardened in small sections, that is, in sections under about 1 inch in diameter. In larger sections they may be satisfactorily air hardened, depending upon the hardness desired, but even in sections as large as 3 inches and 4 inches in diameter there usually will not be over two points Rockwell difference between air and oil hardening. Large sections, however, when air cooled, do not show the same degree of secondary hardness as do oil-quenched specimens and usually there will be a greater difference in the hardness between air and oil-quenched specimens after tempering to 1050 degrees Fahrenheit.

It is necessary to cool all of these steels to a temperature under about 350 or 400 deg. F. before temperin otherwise there is a possibility th decomposition of the austenite wi not take place and the structure o the steel after drawing would be i all respects similar to an undraw piece of steel. Any type of high spee steel in the freshly quenched conditio is quite plastic and can be deforme

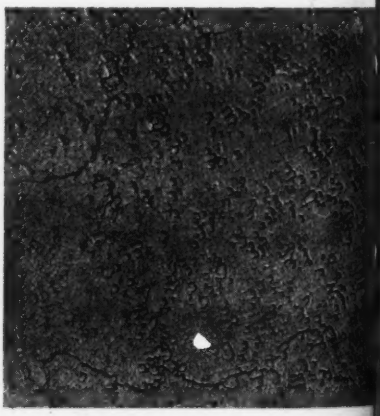

Fig. 24—Photomicrograph showing flaky str ture resulting from a second rehardening high speed steel from the usual harden temperature.

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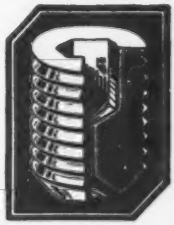

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to a reasonable extent without breakage. It is, therefore, best in the straightening of tools to straighten them immediately after quenching and before drawing.

It has been found that, by increasing the carbon content of high speed steel by pack hardening with a carburizing compound, the wear resistance of the steel is greatly increased and this treatment is used for certain types of blanking dies or wearing parts. A piece of an 18-4-1 steel with an initial carbon content of .70 per cent packed in charcoal and held for 25 minutes at 2000 degrees F. showed a surface carbon content of .78 per cent; at 50 minutes a surface carbon content of .90 per cent and at 90 minutes a surface carbon content of 1.02 per cent.

Attempts have been made to nitride high speed steel with the regular nitriding procedure with rather unsatisfactory results, as usually the edge is embrittled to such a degree that chipping occurs too readily. Some tool makers have immersed the steel in a molten bath of sodium and potassium cyanide at a temperature of about 1050 degrees F. for from 10 minutes to 2 hours. Such a procedure is applied after the steel has been hardened and tempered in the regular manner and some users have claimed exceptional results with the treatment. At least it has proven sufficiently satisfactory to some makers of high speed steel tools so that they use it as a regular procedure. Others who have tried it claim an embrittlement of the cutting edges.

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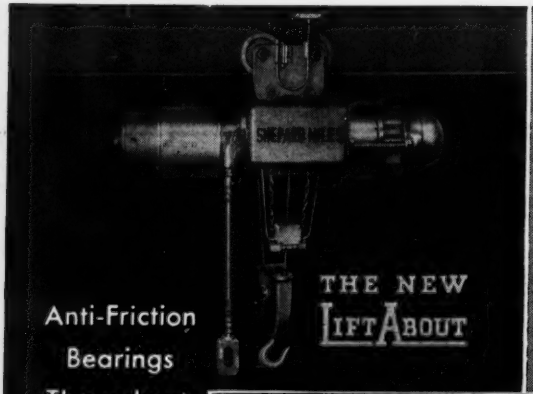

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Lubrication and Gears

A summary of the results that have been achieved through a series of tests made in the Research Laboratories at Stanford University.

By J. Roy Petersen

THE problem of wear on gears has never ceased to be one of interest to machine manufacturers and especially the gear manufacturer who faces new angles of the question every time a new type of gear is designed to meet some special conditions.

This was particularly true with the introduction of the hypoid gear in the automotive industry. Efforts to lower the drive shaft to comply with the trend toward low, streamline automobiles have thrown more and more load on the axle due to a smaller axle and to the necessity for the axle to carry the added power which is today being required of the engine.

This added load has caused an urgent need for different types of lubricants because of the excessive sliding speed of the gears and the high unit loads. This increased load capacity has gone beyond the straight mineral with its lower film strength, and new and special lubricants are needed to prevent extreme wear.

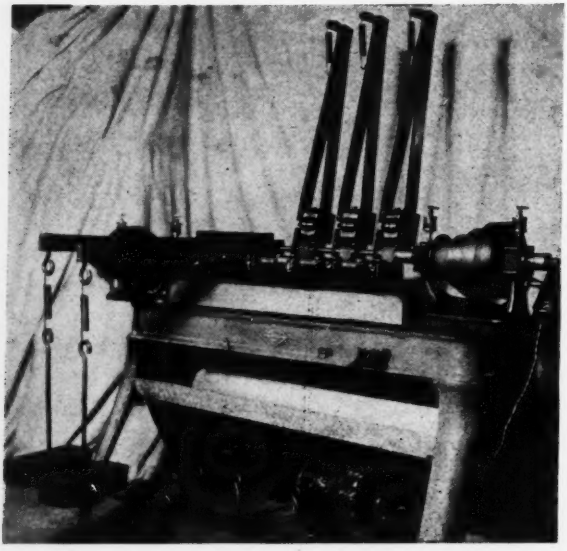

Fig. 1—Machine with two lever arms lowered into position and three lever arms raised to show the construction of the driving box. Heights up to any amount could be added to duplicate the loaded conditions experienced in actual service.

Realizing the need for an adequate method of determining not only the wear on gears but also the ability of certain lubricants to hold up under exacting conditions. Howard Marks and Carl Ross of the Stanford University Research Laboratories in the Division of Mechanical Engineering have been experimenting for the past few months with this problem and have built a machine which simulates the actual operation of gears. The machine, shown in Fig. 1, is so constructed that it can be graduated for different load

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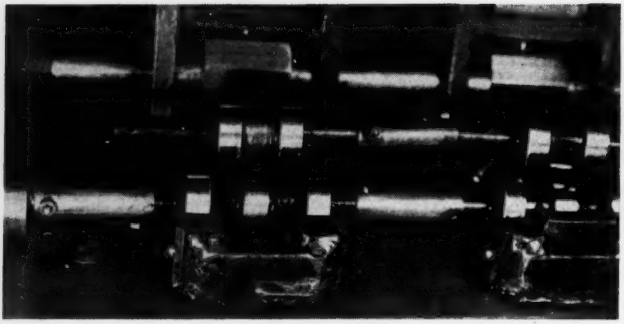

Fig. 2—This illustration shows how the several sets of rollers were attached by sleeves in one long drive shaft. The roller that was measured for wear is the one in the middle at the bottom, the outer two being bearings. The roller at the left was run in worm gear lubricant while the one at the right was run in hypoid lubricant with a heavy base. The left roller is badly scored.

and is made also to test several kinds of lubricant under the same conditions at the same time.

While tests can be made under actual road conditions and in factories allowing geared machines to run for definite periods of time under standard conditions, the value of the testing apparatus of these two Stanford men consists in that it provides an easier and more economical check on lubricants and wear as compared to the more difficult and expensive processes that have been used in the past.

As machine manufacturers and designers are aware, the gear principle reduced to its simplest elements is but a rolling and sliding action, the amount depending upon the type of gear and the load capacities. Taking over this idea, the machine has been designed to employ the use of rollers with which they can duplicate rolling conditions, a combination of rolling and sliding, or pure sliding. The machine was adapted from a similar one used by Westinghouse for tests of pitting on pure rolling contact only. On their machine, Ross and Marks can obtain the rolling and sliding by separately controlling the upper and lower rollers. There were two essential differences between the Westinghouse tester and the Stanford apparatus. The former used individual gear drive but in the latter, the rollers are coupled together with sleeves as shown in Fig. 2. Also, Ross and Marks controlled the upper roller in their experiments while the Westinghouse did not.

While the Stanford machine can make all the tests accomplished on the Westinghouse tester, it goes farther, as will be brought out later, but the correlation of tests made by the two machines is quite significant. Marks and Ross said that they verified many conclusions arrived at by the Westinghouse engineers. They determined that pitting could not be obtained with clean lubricants in pure rolling at a load less than 0.7 of the ultimate

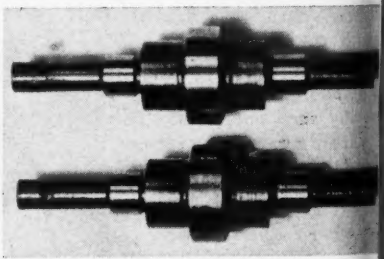

Fig. 3—Photograph of the rollers used in the experiment. Measurements for wear to 0.0000 inch were made.

strength of the steel in the rollers. Results also verified the fact that dirty lubricants pitted the rollers under loads ranging down to 0.3 of the maximum strength.

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As a base for the Stanford gear testing machine, the bed of an old wood lathe was utilized. Lower bearing blocks were mounted seven inches from center to center on a five-inch steel channel which was bolted through a timber that served as a spacer for the lathe bed. Driving was accomplished by lathe headstocks on each end. Bottom mounting blocks, which held the oil pan, were made of cold rolled steel shapes, arc welded. The rollers were mounted in ball bearings. Lever arms 32 inches long, made of structural steel with a forged hook to hold graduated weights which applied the various unit loads, were designed to drop over the rollers. Power was furnished by a 3 h.p. motor of a squirrel cage induction type. This drove a line shaft which in turn drove the head stocks by means of belts.

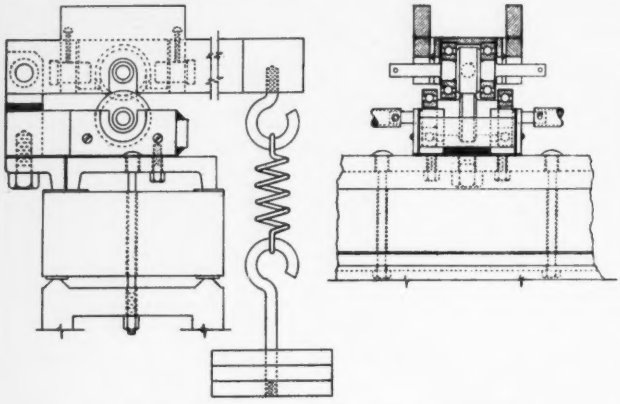

Fig. 4—Cross section drawing of testing machine.

The first tests were rolling tests and were made with the top rollers idling; that is, having no drive, but with the lower rollers being driven 1450 r.p.m. The results already mentioned above checked with similar tests of rolling made by Westinghouse.

By applying power to the top rollers which turned in the same direction as if idling, both the rolling and sliding action which is met in most gears was obtained, but more markedly in hypoid gears. The rollers, upper and lower, were revolved at different speeds. The application of this to the modern auto gear is that the machine can test unit loadings for slippage up to 1200 feet a minute.

Perhaps a word concerning the design of the rollers, Fig. 3, is necessary to get an adequate picture of the experiment. They were made of S.A.E. steel No. 3145 with a Rockwell hardness of C-35. Roughly turned out of bar stock, the rollers were heat treated and finally ground to a standard diameter — the lower ones to 1.576 inches and the upper, 1.5 inches. To insure contact across the complete face of the lower rollers, which were measured to 1/100,000 of an inch, the upper rollers were made ¾ inch wide, while the lower ones were only a half inch in width. Measurement of the rollers to detect wear was done on a Pratt and Whitney measuring machine after the rollers had been allowed to cool for 12 to 14 hours.

There was no appreciable wear on the rollers in the first runs, which were tests of pure rolling. Under the combination of rolling and sliding, accomplished by the two shafts being driven at different speeds, the wear was quite rapid at first but decreased until it was practically negligible after 15 to 20 hours of operation. This tapering off was attributed to the influx of work hardening. The possi-

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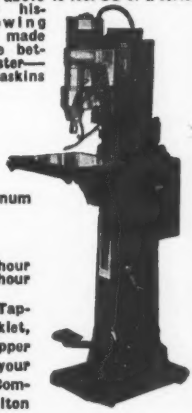

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Depth of Tapped Hole	1⅛"
RPM of Tap "in"	875
RPM of Tap "out"	1750
Production—1st operation	750 pieces per hour
Production—Net—2 operations	350 pieces per hour

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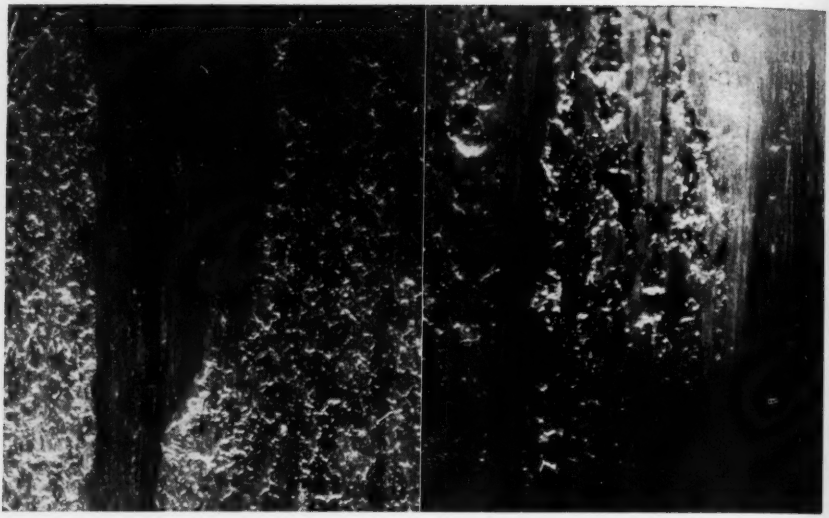

Fig. 5—Surface of roller showing condition after 2¼ hours of slipping action simulating that of a hypoid gear in ordinary worm gear lubricant. Magnification, X 14. Fig. 6—This illustration shows the results when hypoid lubricant fails, as it did, under slippage of 368 feet per minute. Maximum normal unit load, 80,000 pounds. Magnification, X 14.

bilities of flaws in the metal were not investigated, due to the restrictions in scope of the research.

In formulating conclusions for the results obtained so far, the Stanford researchers say that hyphoid lubricants have shown to fail in a lubricating capacity under extreme loads, but they have the ability to smooth the scuffed surface by continued operation at lower loads without appreciable wear.

Effective lubrication is influenced by the load and the slippage. It was found that ordinary motor oil, used mainly for comparison, broke down easily under loaded conditions. The E.P. (extreme pressure) lubricants also broke down but not so easily—the one with the heavier viscosity surprisingly having less film properties to hold up. Worm gear lubricant broke down rapidly under unit loadings at which the mild E.P. lubricants stood up very well. The hypoid lubricant, of course, held

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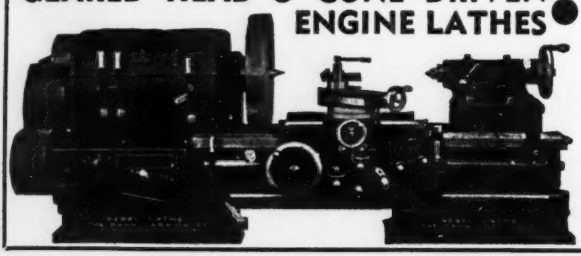

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up best, yet it lost some of its lubricating properties, and acted only as a weld preventative under heavy loads.

In the opinion of the Stanford men, the results of experimentation so far indicate that the lubrication problem has become a vital one with reference to the wear on gears. These results will, of course, have no effect on the design of hypoid gears or any other gears at

Fig. 7—Pitting after 72 hours pure rolling with a heavy load at 1450 r.p.m. in ordinary motor oil. Before running, this steel had a Rockwell hardness of C-35. Magnification, X 14.

the present time. It will, however, encourage more experimentation with lubrication to furnish the production engineer and machine manufacturer with oils that will meet the many needs of present-day conditions of load, speed, and gear operation.

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Additional Notes on Boring Long Holes in Frame of Recoil Mechanism of 75 mm. French Guns

By A. L. DeLeeuw

IN my article on the boring of long holes in the frame of the recoil mechanism of the 75 mm. French guns (Page 66 August, 1937, issue Modern Machine Shop), mention was made of two cradles. In some way these cradles were mixed up. This is not as serious as the mixup of babies, which everyone must have read about in the daily papers; nevertheless it is confusing.

One of these two cradles was meant for the lay-out machine and the other for the actual drilling of the holes. The sketch of one of these cradles shown in the first part of the article shows the essential elements of the drilling cradle, and the description of it at that point would make the reader think that it was used in the lay-out machine. Now, these two kinds of cradles were not at all interchangeable.

In the lay-out machine, the work piece was so adjusted that all of the sliding rods would touch the piece—if this were possible at all. If it was not possible, then the forging was rejected, for it would not be possible to clean it up at all points. Once the piece was adjusted, something had to be done to make sure that, in the various succeeding operations, there should be no stock to be removed. For this purpose, the two holes at each end were drilled. These holes served as gage points for the first operation, which consisted in the planing of two strips. These strips then served as gage points for all further operations.

The reason why two holes, and not just one, were drilled at each end was that a single hole at each end would still leave the position for subsequent operations undetermined. The piece could be revolved around the axis if there were only one hole at one end. If there had been two holes, but at one end only, it would be possible to lay the forging down with one end too much to the right or left, or too far up or down. It would have been sufficient to have two holes in one and only one in the other, but this, too, would have led to some trouble, for it was sometimes necessary to turn the piece end for end in order to reach certain points with the tool. Besides, it took no more time to drill two holes at each end than it would take to drill one hole at one end and two at the other.

These preparatory holes were drilled in the positions occupied by the final long holes. The fact that the forging had to be adjusted to some as yet unknown position when it was first laid in the lay-out machine precludes the idea that the cradle in which it was laid was centered in the faceplate of a lathe. The article speaks of a lathe bed used for the main frame of this lay-out machine, but this was only done because such a bed was available and eliminated the necessity of making a pattern and casting. The machine itself bore no further re-

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semblance to a lathe. There was n faceplate, and, consequently, nothin could be centered with it.

However, the machine in which th drilling was done was a lathe. Ther was a headstock with a faceplate, an it was essential that the forging which, by that time, had undergone number of operations, should be cen tral with the spindle of the machine The jig, or cradle, holding the forging for the drilling operations, was turne at both ends as the diagram showe This permitted the jig to be place exactly central with the faceplate and, therefore, with the spindle.

It is hoped that the foregoing wi clear up whatever confusion may hav been caused in the mind of the reade by the misplacement of the diagram and its description in the previou issue of the magazine.

"Tools of Industry by Williams" is th title of a 184-page catalog now bein issued by J. H. Williams & Co., 7 Spring St., New York, N. Y., which de scribes the entire industrial line o drop-forged wrenches and other stand ard stock specialties made by this firm Included are many additions to thei Carbon and Alloy Wrenches, detachabl "Supersocket" Wrenches and "Agrippa Tool Holders.

The following new lines are also listed adjustable wrenches, both carbon and alloy steel; "Non-Sparking" Safet Wrenches (Beryllium-Copper); "Superec tor" Reversible Ratchet Wrenches with detachable sockets for severe service; two new lines of "Vulcan" Chain Pipe Tongs—"Supertongs" (alloy steel) and "Zephyr" (light weight). Both lines o tongs are equipped with new alloy steel "Superchain" which is said to be o greatly increased strength. Copy fre upon request.

Gits Brothers Oiling Devices. This catalog, now being issued by Gits Broth ers Manufacturing Company, 1901 S. Kil bourn Ave., Chicago, Ill., lists and illus trates more than one thousand style and sizes of oil cups, oil and grease seals, oil cans, gages, and other lubri cating equipment made by this firm Copy free upon request.

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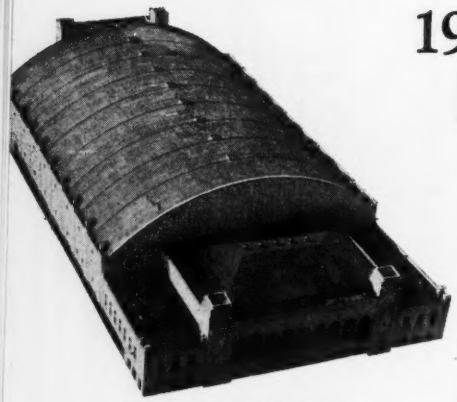

Atlantic City Auditorium *

19th National Metal Congress and Exposition

FIVE great technical societies are cooperating in presenting, for the benefit of American Industry, the Nineteenth National Metal Congress and Exposition, which is to be held in the Atlantic City Auditorium, Atlantic City, New Jersey, October 18 to 22 (inclusive), 1937.

The membership rosters of these five societies include the scientists, engineers and technicians who are most largely responsible for the factors of safety, performance, high production, and corresponding low costs which as a result of their research in metals are the outstanding characteristics of American metal manufacturing. For the past twelve months these men have been working quietly in their laboratories developing new metals or new methods of processing the metals now in use. The National Metal Congress is the one time in the year when they leave their laboratories and get together to compare notes and report on the developments that have taken place and the results that have been obtained since their last meeting. This convention will afford an opportunity for all who are interested in the scientific side of metal manufacturing to bring their knowledge up to date.

American Society for Metals program will include a two-day symposium on carburizing, with fourteen technical sessions. Thirty other papers on a variety of metal subjects will also be presented. Two lecture courses will occupy the hours of late afternoon and evening, one comprising a comprehensive five-lecture series on steel making, the other consisting of three lectures on metallographic technic. These lecture courses will be presented by men who are acknowledged peers on these subjects.

American Institute of Mining and Metallurgical Engineers program will include a round table discussion on "Physics of Metals", a technical session, and the annual "Science Lecture" of the A.I.M.E. which this year deals with "The Behavior of Gases at Metal Surfaces." A joint sponsorship of the round table discussion by the A.I.M.E., A.S.M., A.S.T.M., and American Institute of Physics promises a wide range of viewpoint and opinion. Other technical sessions will be devoted to general metallurgy, metallography, and open hearth practice.

American Welding Society has arranged a well-balanced technical program with sessions on both industrial and fundamental research in welding. Other aspects of welding which will

*Sky-view by H. H. Harris, President General Alloys Co.

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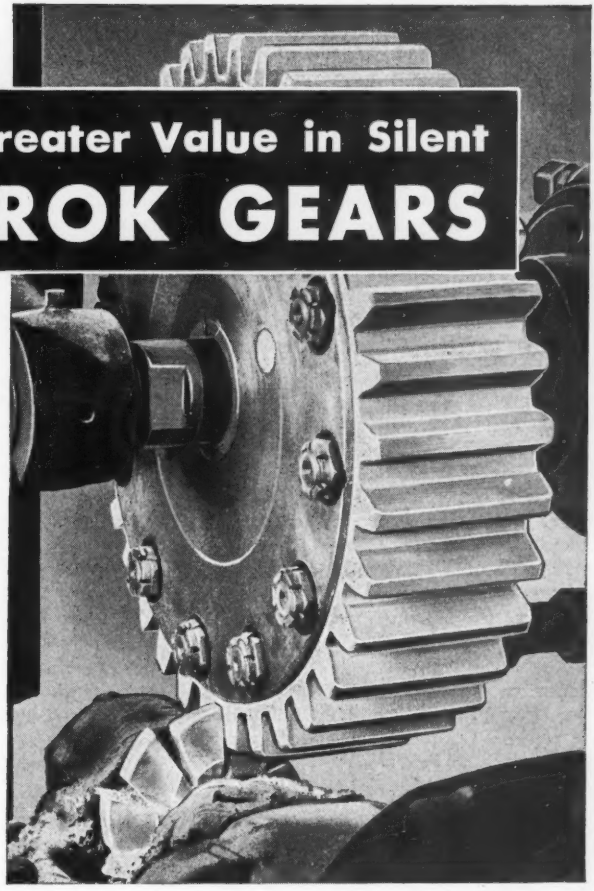

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form the subject of separate sessions are Fabrication by Welding, Shipbuilding, Welding on Railroads, and Welding of Alloy Steels. The Fundamental Research Committee will again meet to discuss work done and plan future projects.

American Society of Mechanical Engineers will have a one-day program presented jointly with the American Welding Society in which the mechanics of welding and the relation of design to welding will be featured. This will be a very interesting and valuable discourse on a very important subject.

The Wire Association will have the usual informal discussions and the Association's headquarters at the Ambassador Hotel will be open from 9 a.m. to 11 p.m. daily for this purpose. A varied group of papers will also be presented at the daily technical sessions. The subjects featured in the Ferrous Division will include, Fatigue of Springs, Pickling, Cold Heading, Grain Growth, and Galvanizing. The Non-Ferrous Section will listen to papers and discussions on the Production of Copper, Fourdrinier Wire, and Copper in Apparatus Manufacture.

The National Metal Show will include displays of more than 225 leading industrial organizations among which will be actual operating exhibits presenting the newest developments in plant and research equipment. Every aisle in the huge auditorium will be lined with exhibits representing the most modern ideas in metal research, and in attendance at each exhibit will be metal and equipment experts to answer questions about their products. Altogether, this Metal Congress and National Metal Show will provide the one opportunity of the year for the engineer or manufacturing executive to obtain, firsthand, answers to the problems which have confronted him during the past twelve months. The five technical societies listed above have combined in inviting the visitor to the Show to bring his problems with him and will be only too glad to see that he meets the men who will understand his problems and can give him the right answers.

Registration is the only requirement for admission to the National Metal Congress for any engineer, technician or executive engaged in any phase of the metal industries.

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A copy of this completely illustrated beautiful, colored book will be sent no charge to anyone directly interested in the purchase, operation or maintenance of electric motors if requested on company stationery.

Foote Gears, Speed Reducers and Couplings. A beautifully-printed book containing 72 pages of description and illustrations of the speed reducers, gears and couplings made by Foote Gear Works, Inc., 1301 S. Cicero Ave., Chicago, Ill., is now being distributed by that firm. The book explains the construction and design details of Foote heavy duty worm gear speed reducers, herringbone speed reducers, and Foote couplings, and also presents ordering data, selection information, list prices, weights, ratings, dimensions, lubrication data, and whatever information may be of interest or value to the user of equipment of this type. Many photographs and cross-section drawings are included, together with tables of specifications. Copy free.

Modern Equipment at Work

Copper Plating for Lubrication

WHEN the word "lubricant" is mentioned, it is customary to think of grease or oil, consequently the idea of copper serving as a lubricant is—to say the least—unusual. But it is performing that function, and successfully, too.

Some time ago it was discovered that copper, when used to impregnate the surface of iron or steel, imparts a lubricating quality to the surface of the metal. There are many places where this discovery can be used to advantage, among which is the contact between the cam on an automobile engine camshaft and the valve lifter. In the Oldsmobile the camshaft is of alloy cast iron and the valve lifter is of hardened steel. At a speed of 60 miles per hour, each cam in an Olds engine revolves under its valve lifter 1550 times per minute, and with 12 or 16 of these cams operating as many lifters at this speed, the need for a helpful lubricating agent is obvious. The application of a film of copper to the cam simplifies the problem at the time when it is most important — during the "running-in" period.

The secret lies in the fact that, as the surface of the cam slides over the flat surface of the steel cam lifter, the lifter "wears" the copper into the pores in the surface of the cam and imparts to it an initial quality which can only be described by the word "lubricated." In other words, the combination of the copper with the hardened steel substantially reduces the coefficient of friction and precludes the possibility of scoring during the initial running-in of the motor.

The copper plating operation referred to is the last operation on the shafts; thus they are finish-ground to size before arriving at the plating tank. The equipment consists of the Meaker Return-Type Quick Transfer Automatic Plating Machine shown in the illustration. The machine consists primarily of five baths in sequence, arranged to handle the shafts in and out of the baths automatically and including the necessary accessory equipment. The machine is approximately 18 ft. 5 in. long overall and 9 ft. wide, with a height of approximately 12 ft. 4 in., which is necessary

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due to the length of the shafts. The machine will handle 100 shafts per hour, depositing from 0.0002 to 0.0003 in. of copper on each shaft.

The machine is arranged to perform the following sequence of operations:

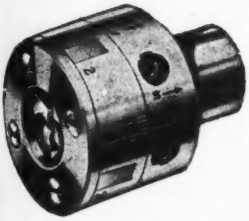
1. Alkaline Cleaner	1½ min.
2. Rinse	½ min.
3. Copper Plate	15 min.
4. Cold Rinse	½ min.
5. Hot Rinse	½ min.
	18 min.

A coating of copper on the cams serves as a lubricant and helps the Olds engine to run smoother and easier during the "running-in" period.

Carriers are of the double-file type, carrying two camshafts on each side, or between each row of anodes. The conveyor carries the shafts down one side and returns them on the other side having passed them through the various cleaning, rinsing, and plating operations and delivered them back to the starting point a finished job.

In the plating operation a single strand conveyor cannot be employed because of the time required for raising the material out of one tank and lowering it into the succeeding tank. Unless the transfer can be made quickly, oxidation begins and even a small amount of oxidation interferes with the proper plating of the surface.

To overcome this objection, a transfer mechanism has been developed which raises the hanger from the conveyor, advances it over the end of the tank, and



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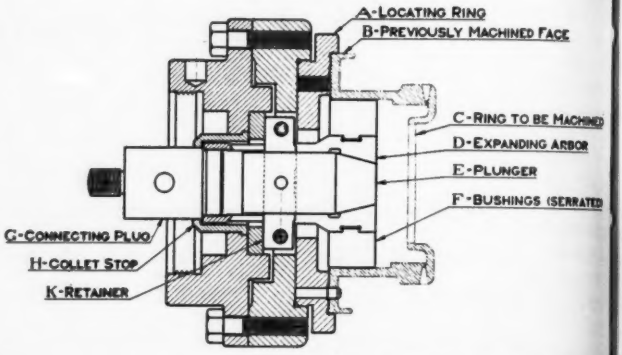
lowers it into the succeeding tank in a period as short as from 10 to 15 seconds. If the carrier were permanently attached to the conveyor, from 1½ to 2 minutes would undoubtedly be required for the work to travel the same distance, which would allow time for oxidation and thus make the operation impractical.

The use of automatic equipment for this operation makes it possible to establish a definite amount of time for each processing operation. With the conveyor set for a definite speed, it is evident that a certain definite amount of metal has been deposited, and that the cleaning and rinsing have been properly done.



Drawing showing cross-section of fixture by The Warner & Swasey Company to machine a self-aligning coupling.

Machining 13 Surfaces at One Setting of the Work

THE rapid machining on a production basis of very accurate parts frequently offers unusual problems How these were solved at the Bartlett-Hayward Company, Baltimore, Division of Koppers Company, is shown in the accompanying illustration.

The job is a self-aligning coupling for direct connected power units. In service, the coupling provides for misalignment of two rotating shafts where extreme care must be taken to avoid bending stresses and the resulting pressures on bearings. An essential part of the coupling is the combined ring and sleeve, which both engages the unit and controls the center line of each shaft. This part must be very carefully machined. Finish cuts must be accurate to within 0.001 inch.

The problem was to chuck quickly on a turret lathe the ring-sleeve forging, which had one face and diameter already machined. All cuts thereafter had to be made in relation to this already machined surface. A special air-operated fixture assembly was designed by The Warner & Swasey Company, Cleveland, turret lathe manufacturers, for accomplishing the desired result and holding to the allowable limits of accuracy and at the same time allowing for internal clamping so that the maximum number of operations could be performed at one setting of the work.

The diagram shows a cross section of the fixture, the important elements of which is the locating ring A. Note also the floating expanding arbor D with its bushings F, plunger E, retainer K, and connecting plug G.

With this special fixture attached to the lathe spindle, the operator simply slips the ring-sleeve, which has a face previously machined B, into the locating rings and turns on the air pressure. The pressure on the plunger

(*Continued on page* 144)

for Results-

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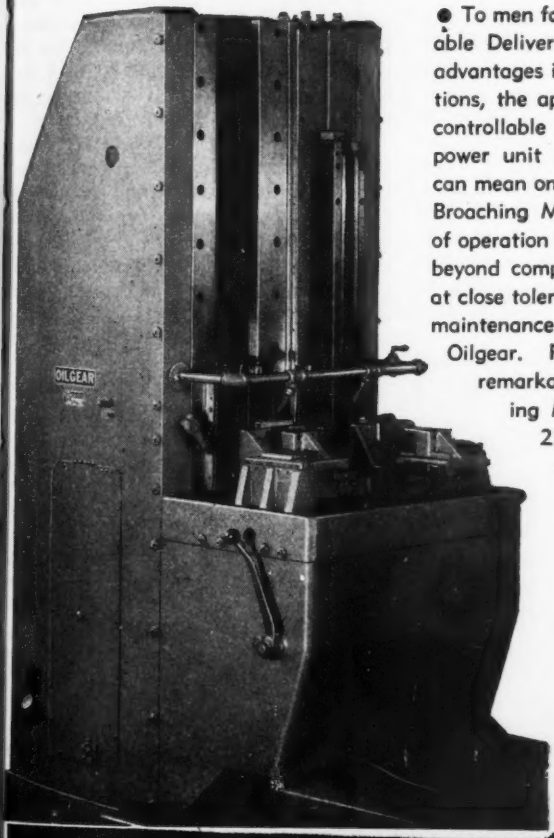

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Ideas from Readers

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

Universal Cutting-off Fixture

By John A. Honegger

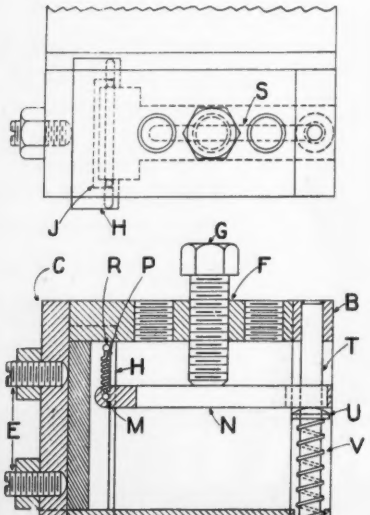
IT frequently becomes necessary to cut material—either round, square, hexagon, or rectangular—to length on a production basis, using either a power hack saw, milling machine, or band saw. Vises of the ordinary type can, in some instances, be used to hold the work for such operations, but because the vise confines the workpieces in one direction only, a considerable amount of time may be consumed in aligning the pieces or evening the ends in the other direction.

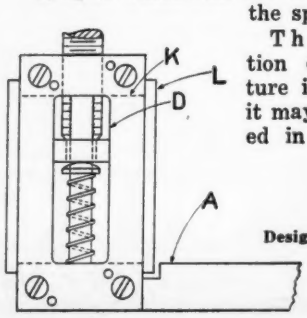
To facilitate the accurate aligning of a large number of bars or rods for cutting off purposes, the fixture shown in the accompanying illustration was designed. The fixture can be adjusted to take any number of rods within its capacity, and is identical at each end of the spacer plate A, which can be made to any length required.

To the sides of the plate A are attached the uprights B and C. The rectangular slot D is milled in upright B, and two holes are tapped for the adjusting screws E in upright C. The upper crossrail F is fastened to the upright members as indicated. Three holes are drilled and tapped in the crossrail F, the central hole being for the clamp-screw G.

Between crossrail F and spacer plate A slides the adjustable upright H. A T-slot J is milled in upright H, as well as the recesses K which form the lugs L. In the T-slot slides the pin M on the leaf N. To this pin are attached the springs P, which in turn are attached to the pin R. Leaf N has an elongated slot milled in it to allow for horizontal movement of the leaf. In the front end of the leaf is the pin T, upon which ride the washer U and the spring V.

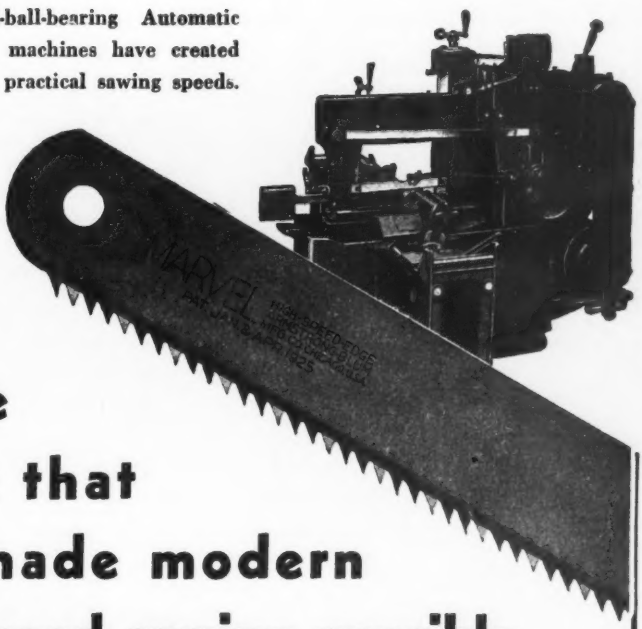
The construction of the fixture is such that it may be adjusted in both hori-





Design of Fixture for Holding Work for Cutting Off

the MARVEL all-ball-bearing Automatic Production Sawing machines have created a new standard for practical sawing speeds.



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zontal and vertical directions so that any number of pieces can be inserted and securely clamped. If this fixture is held in the ordinary type of vise either in a power hacksaw or on a milling machine table, it will give complete satisfaction.

Squaring Locomotive Frames

By F. N. Burch

NUMEROUS methods have been employed to make locomotives track square; in other words, to keep from cutting the driving wheel flanges. We have used the fish-tail tram and have run lines through cylinders, but still experienced a lot of trouble with flange-cutting. The trouble has been overcome, however, by squaring the locomotive wheels with the frames instead of squaring them with the cylinders. The method used is very simple.

The instrument used for this task consists of a pair of spacers and a tram, with the necessary accessories. The spacers are made from two 8-in. lengths of 1-inch T-iron, each of which is welded to the center of a rectangular piece of soft steel 1x4x6 in. in size, as shown at A, Fig. 2. The flat side of the rectangular piece is ground smooth opposite the weld, then, using a thin saw, a slot ⅛ in. deep is cut in the vertical section of the "T" at a point near the end, as shown. It is important that the slots in the two pieces be exactly the same distance from the smooth sides of the rectangular pieces.

In use, the spacers are clamped to the frame near the approximate centers of the driving wheels; at the front driving box shoe and the rear driving box wedge as shown at A,

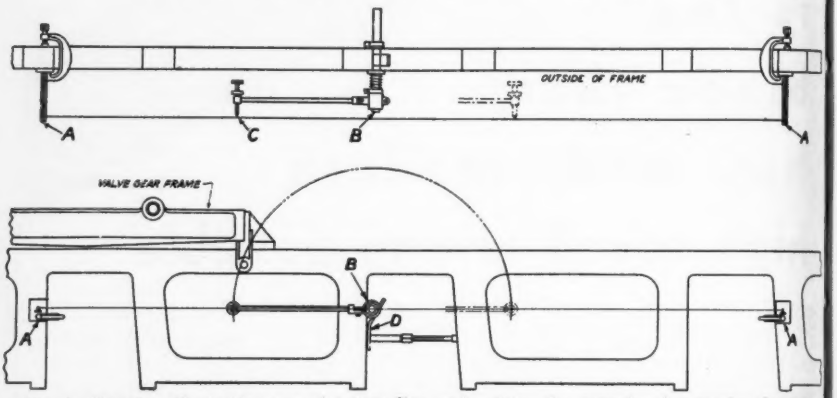

Fig. 1—Drawing illustrating use of a taut line and pointer for squaring locomotive frames.

Fig. 1. Then a thread, with some small object such as a nut tied onto the end to hold it, is slipped into the slots in the spacers and drawn taut. If the slots are properly cut in the spacers, the thread will be the same distance from the frame at both ends.

The tram consists of two pieces; the shaft and the pointer. The shaft is made from 2¼-inch steel tubing and is cut 12 inches longer than the spread of the frame. This extra length is to allow the shaft to project beyond the sides of the frame so that the pointer can be assembled to it as shown at B, Fig. 1.

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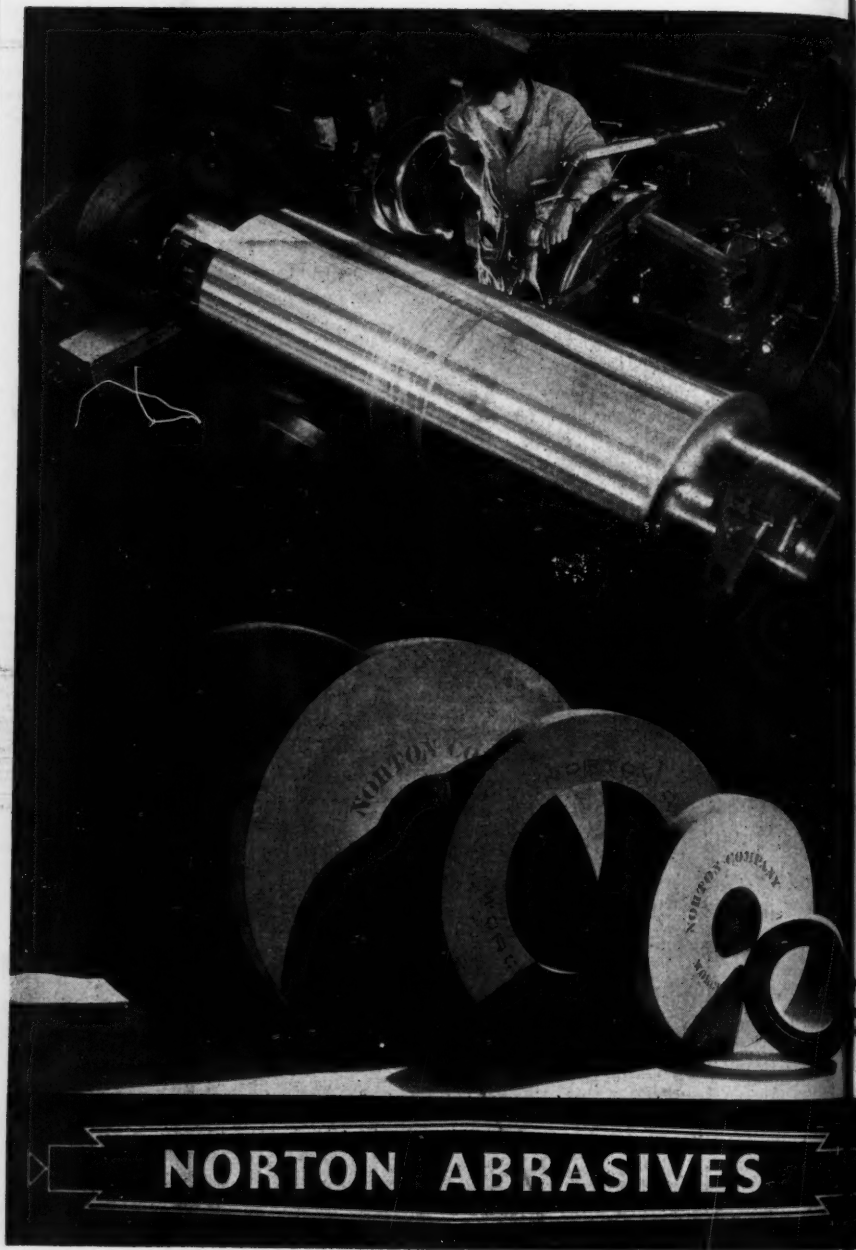
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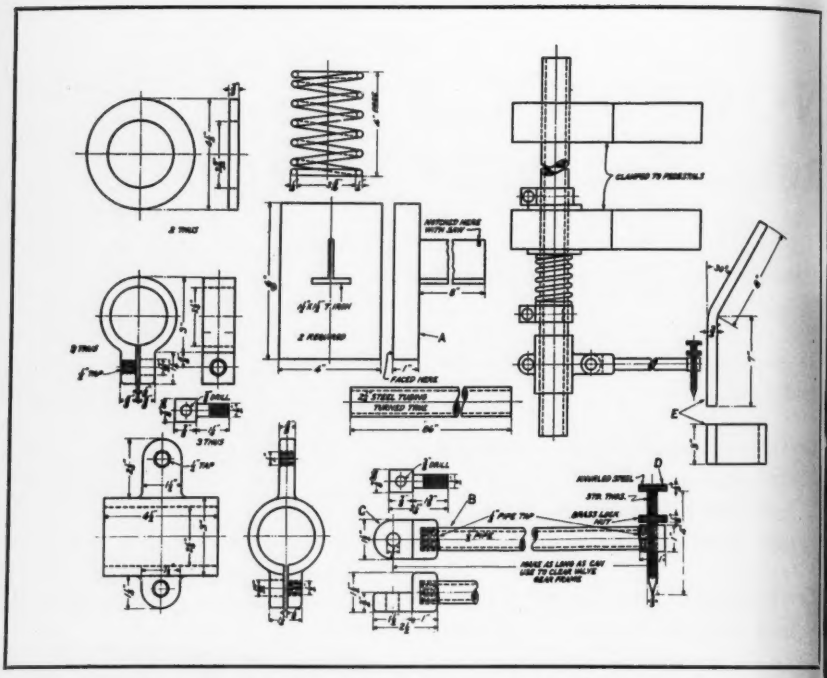

Fig. 2—Detail drawing of parts required for instrument for squaring locomotive frames.

The pointer is made from ½-inch pipe as indicated at B, Fig. 2, which is as long as it can be made and still clear the valve gear frame. One end of the pipe is screwed into a clevis, C, which is bolted to a fitting on the end of the shaft as shown at B, Fig. 1, and the other end of the pipe is screwed into a block through which a hole has been drilled for the thumbscrew D, Fig. 2.

When ready to square up a frame, the shaft is placed in position in the angles of two angular pieces designed as shown at E, Fig. 2, and held in place on the right and left frames by spreaders as shown at D, Fig. 1. These pieces are made from ¾x3x18-in. soft steel, bent to a 30-deg. angle as shown. With the spacers in position and the thread taut, the pointer is adjusted until it just touches the line at either front or back and is then swung to the other direction. If the shaft is not square with the line, a shim is placed behind the shaft and adjusted until the pointer will touch the line on both sides. When the line is at right angles to the shaft, the square of the line is transferred to the frame with a square.

When the pointer is moved from front to back, the shaft is kept from moving by means of a set collar which is placed next to the inside of the frame with a set collar and spring on the outside. As the pointer is clamped to the shaft, the shaft revolves when the pointer is swung back and forth.

Since using this device, we have cut our flange wear 50 per cent. The other 50 per cent is largely due to such

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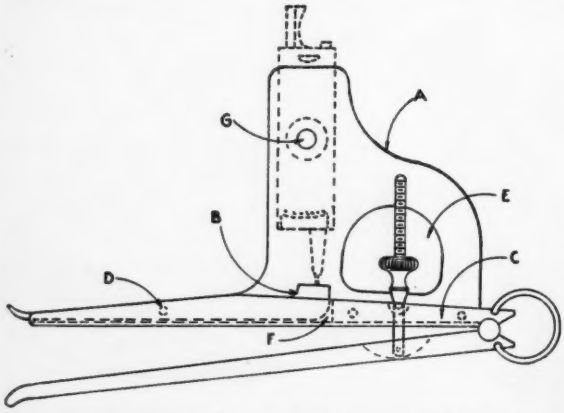
causes as loose center castings, laterals not properly divided, listing of engine on account of worn spring rigging, and so on.

Caliper with Indicating Leg

By Jos. R. Cowles

THE drawing presents the design of an indicator which has one leg pivoted in such position that it controls the plunger of an indicator, thus making it possible to determine a variation in dimensions by thousandths of an inch. Such a tool makes it unnecessary to continually reset and regauge holes in transferring measurements or in making fits.



Drawing of caliper equipped with indicator and pivoted leg.

The caliper illustrated is of 6-in. capacity, and the indicator is a "Koch." However, an "Ideal," "Last Word," or any other light indicator will serve the purpose.

One leg of the caliper is cut off at the point indicated at F. A section of 1/16-in. cold rolled steel plate is then cut to the shape indicated as A, enough stock being left at the lower right hand edge so that it can be folded around the short leg C and riveted to the leg as shown. An opening E is made for the adjusting nut.

A substitute leg B is made and pivoted at the point D to the sheet steel frame, the leg being of the same shape as the original leg with the exception of the part at the point of the arrow B, which is made to serve as a base for the plunger of the indicator. The indicator is held to the frame by its stud, which is inserted through the hole G and the thumb nut screwed on at the other side of the frame. This hole will have to be positioned according to the type of indicator used, and must be located so that the plunger will record any pressure on the point of the leg, as, for instance, when the

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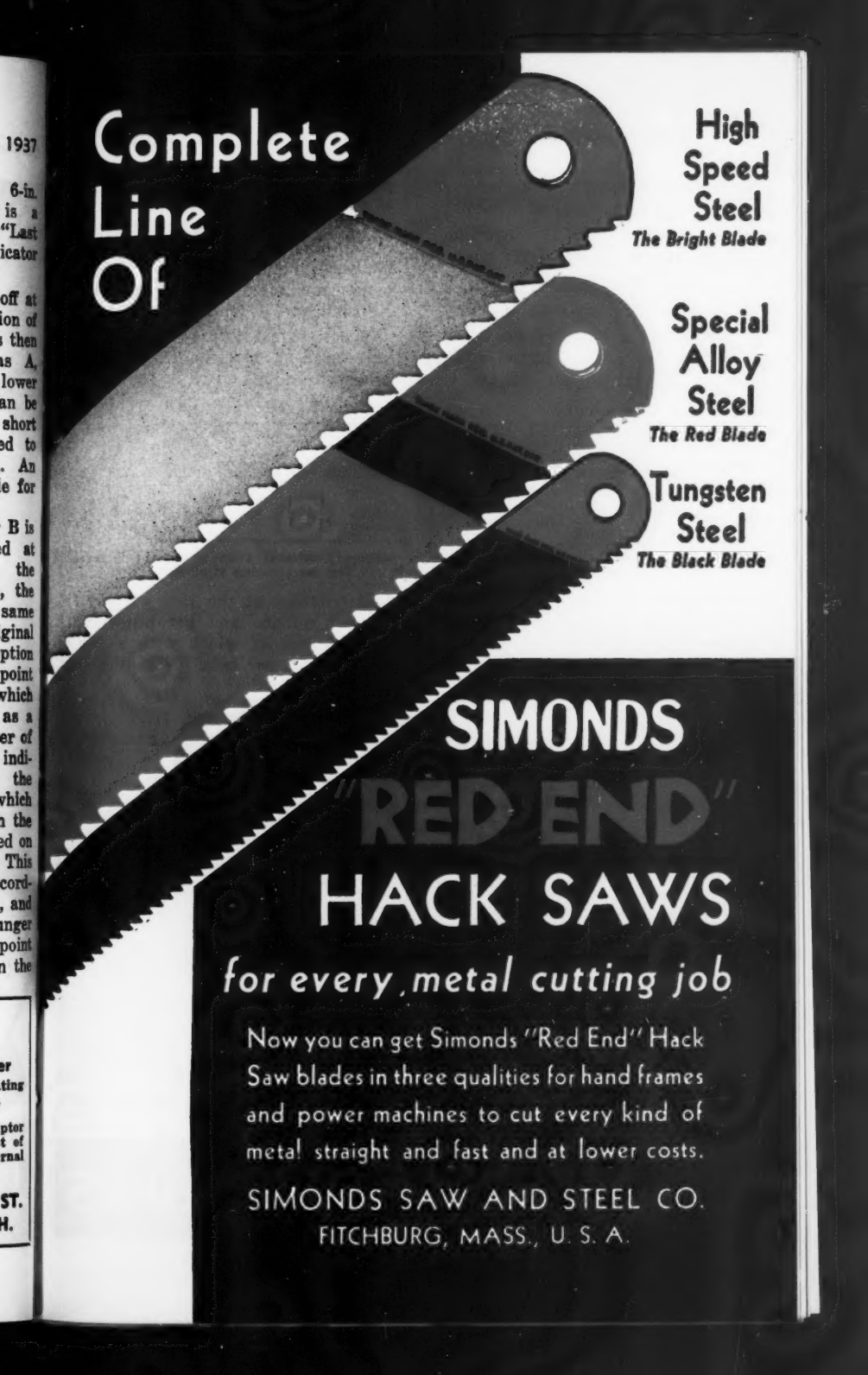
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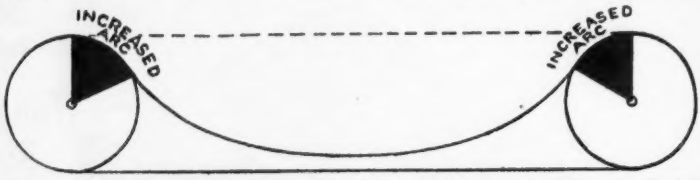
caliper is being used to discover the amount of out-of-round of a hole.

Are Slack Belts Impracticable?

By W. F. Schaphorst

I HAVE been severely criticized a number of times for advocating slack belts. My critics tell me that slack belts are not practical. They say that one must have considerable tension in the slack side to make any belt pull full load. I am prepared to prove, however, that the contentions of these contenders are not true. One of the most recent and most convincing proofs comes from Ohio State University, and is the result of experiments conducted by Professors C. A. Norman and G. M. Moffat.

These investigators ran a leather belt on 6-in. steel pulleys and 6-in. cast iron pulleys on 15 ft. centers. The belt traveled at the rate of only 895 ft. per minute and yet pulled 104.8 lb. per inch of width with a slip of less than 2 per cent. Was the slack



This drawing shows how the arc of contact o belt running over a pulley can be increased from approximately 180 deg. to 240 deg. by running it slack.

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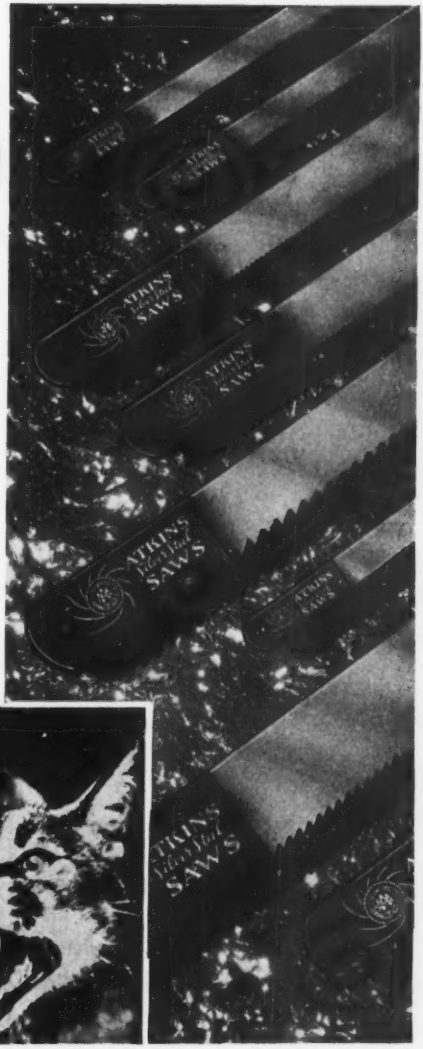

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side actually slack? Indeed it was. The belt sagged so much that the slack side almost touched the tight side, making it impossible to run the belt more slack. The tension ratio was 30, which means that the tension in the tight side of the belt was 30 times that in the slack side. Or, in actual figures, the tension in the tight side was 104.8 lbs. and in the slack side 3.49 lb. per inch of width.

My sketch herewith shows one important advantage of running belts slack. The black areas show the increased arc of contact that is obtained by running the belt slack. The dotted line shows where the belt would be if it were tight. In this instance if tight the arc of contact on each pulley would be only 180 degrees. By running the belt slack as shown, we have a total of 240 degrees. Since pulling capacity increases as a power of the arc of contact multiplied by coefficient of friction it becomes clear why slackness is possible and also why slackness is desirable.

The chief requisites of slack belt drives are: (1) a high coefficient of friction between the belt and the pulleys; (2) good shaft and pulley alignment; and (3) a steady load. If the load is variable, such as is common with compresser drives or hammer drives, extreme slackness without the use of a wrapper pulley is inadvisable owing to the flapping of the belt that is sure to result. A wrapper pulley, however, will eliminate all flapping and generally is a "good thing" on any drive.

Machining 13 Surfaces

(*Continued from page* 130)

through the connecting plug expands the arbor whose serrated jaws grip the work from the inside.

Using both the square and hexagon turrets, as many as 13 surfaces are machined on one setting of the work, accurate to within one thousandth.

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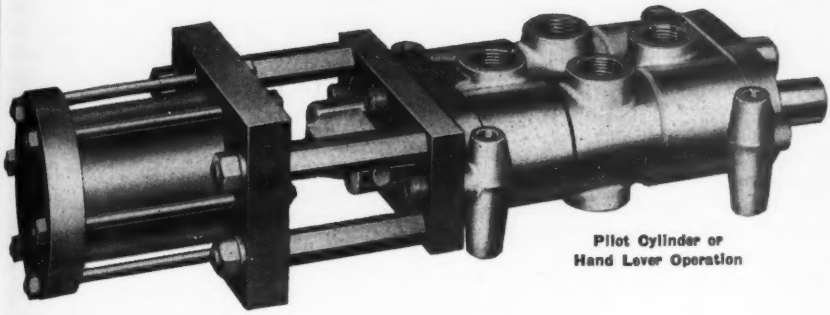

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Built on the Q. A. W. principle of No Metal-to-Metal wear in the valving action, stainless steel plungers, short travel, and balanced action, these new valves offer extremely long life in hard service. Inspection and re-assembly in a few minutes.

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Over the Editor's Desk

Competent Supervision

THE article on page 74 of this issue describing the manner in which foremen's conferences are conducted at the plant of the Crosley Radio Corporation should be of interest to the managing executives of every modern plant, especially where there is no foreman training program at the present time.

The advance of civilization as evidenced by the development of all kinds of accessories to better living has developed a demand for shop executives of a better class than had previously been considered necessary. Thirty years ago the first requisites of a good foreman were mechanical ability and sufficient intelligence to get the work out on schedule. Many of the foremen, superintendents, and other manufacturing executives had, as boys, taken machine shop jobs due to economic necessity and in many cases these men were without so much as grade school educations.

The new foreman having been placed in charge, the job was "up to him." If he had difficulties with his men, or with his equipment, or with anything else involved in the operation of his department, it was his problem. If he had faults, they were usually condoned as long as he could produce accurate work on schedule time.

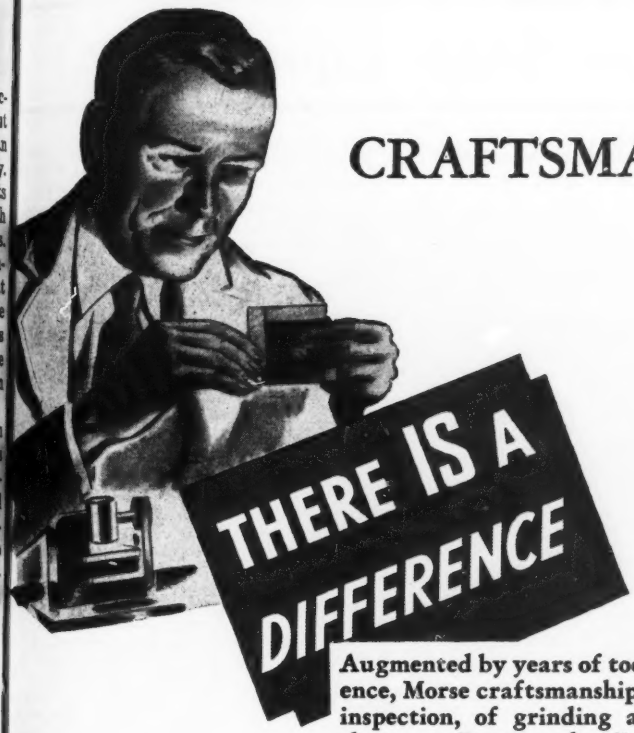
Modern industrial methods necessitate supervision of a higher type. It is not enough that the foreman know how the work should be done; he is expected to know enough about tool materials and design to know whether tool performance in his department could be improved, enough about the equipment available in the market to know whether his production could be improved, enough about materials to make suggestions regarding manufacturing methods, and enough about managerial functions so that he can keep his department running smoothly.

Information on all of these subjects except the last one is available through books and the technical magazines. Many books have been written on management, but there is nothing that will educate a man along this line quite as well as hearing his problems discussed by other—and perhaps more experienced—executives in his own plant or his own industry.

The conference method of foreman training has long been recognized as the most effective method of developing first-class executives and we shall be very glad indeed to supply additional information on this subject to any factory executive who is considering the inauguration of a foreman's conference.

A Slight Error

IN our discussion of the manner in which Social Security funds are being handled, which appeared on the editor's page in the September issue of this magazine, we state that "withdrawals for Social Security pensions have already begun." We were in error; pensions are being disbursed in our own state of Ohio from the state pension fund, but the national Social Security pension payments will not start until 1942. However, the fact still remains that—according to the Hon. Dudley A. White of Ohio—the Social Security tax money is being used for current expenditures, government bonds being deposited by the government to take the place of the tax monies. And we are still interested in knowing where the money is going to come from to redeem these bonds.



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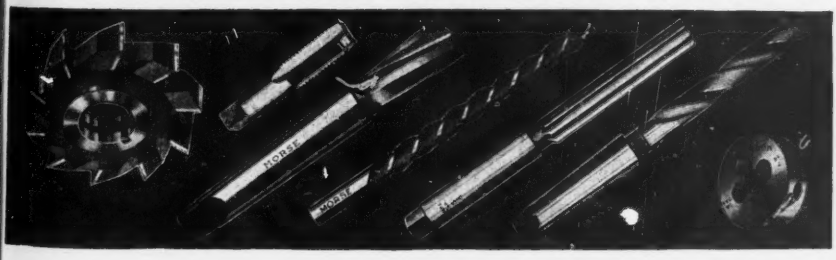
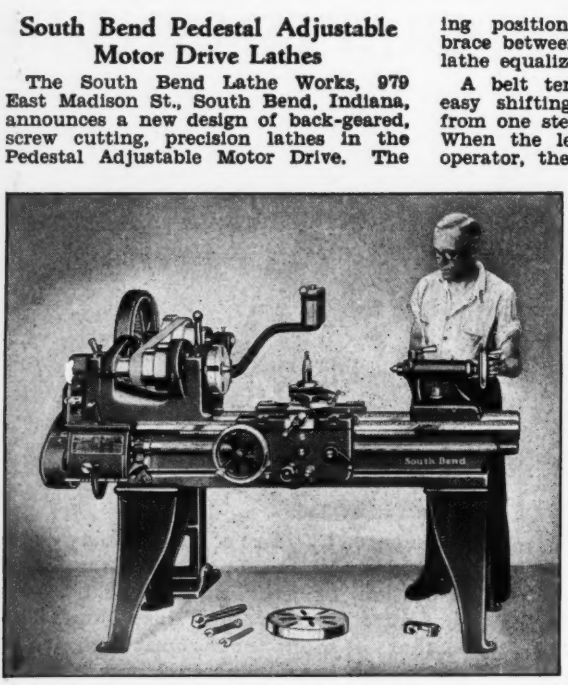


New Shop Equipment

South Bend Pedestal Adjustable Motor Drive Lathes

The South Bend Lathe Works, 979 East Madison St., South Bend, Indiana, announces a new design of back-geared, screw cutting, precision lathes in the Pedestal Adjustable Motor Drive. The new drive is available in the five sizes of South Bend Precision Lathes—9 in., 11 in., 13 in., 15 in., and 16 in. swing, and in bed lengths from 3 ft. to 12 ft.



South Bend Pedestal Adjustable Motor Drive Lathe

The pedestal adjustable motor drive mechanism is a separate unit with the motor and countershaft mounted on a pedestal back of the lathe in a position horizontal with the headstock cone pulley of the lathe. Power is transmitted from the motor to the countershaft by V-belts, and from the countershaft to the lathe spindle by flat leather belt, providing a smooth, steady pull, free from vibration and chatter. The reversing switch is conveniently located near the lathe spindle and permits the operator to start, stop and reverse the rotation of the lathe from an easy working position. An adjustable tens brace between the countershaft and t lathe equalizes the pull of the belt.

A belt tension release lever permi easy shifting of the cone pulley b from one step of the pulley to anoth When the lever is pulled towards t operator, the motor drive is tilted fo ward on its pivotin frame sufficiently easily shift the spind belt. The V-belts fr the motor to counte shaft are enclosed in substantial guard.

Several new features the pedestal motor dri include: Motor entire apart from the lat thus eliminating vib tion; silent belt dri providing a smooth stea pull; no overhead be to obstruct vision or cast shadows on t work; V-belts from m tor to pulley enclosed a guard; screw type b tension adjustment any desired pull power; and release shifting belt to chan spindle speeds.

The new lathes have number of new featu and improvements, t most outstanding which are: Heat-treat headstock spindle with all bearing su faces hardened and ground, includi the taper hole; spindles are special al steel, with phosphor bronze bearing line bored and lapped to a perfect be ing and adjustable for wear; new doub wall apron with self-oiling steel gea and all gear shafts supported on bo ends; a multiple disc friction clutch apron, and so on.

South Bend Pedestal Adjustable Mot Driven Precision Lathes are built in bo the quick change gear and standa change gear types. Quick Change Ge Lathes are equipped with a quick chan mechanism for cutting 48 right and l hand standard screw threads rangi from 2 to 112 per inch, including 11 pipe thread. Standard change g

thes are equipped with a set of loose hange gears for cutting right and left nd screw threads from 2 to 40 per nch, including 11½ pipe thread.

imatool Bolender Gear Burnisher

A new Bolender burnishing machine or improving and truing up the surfaces f gear teeth is announced by the Cimaool Company, 3rd St. at une, Dayton, Ohio. While any of the basic features f the original Bolender achines have been reined, the new unit incorporates so many important mprovements that it does ot bear much resemblance o its predecessors.

The characteristics of this achine which make it parcularly attractive in the eld of gear finishing are 1) greater ease and speed both set-up and changeer, (2) higher production peed, (3) better control of ressure between gears, and reater range of pressure vailable, (4) greater accuacy in alignment between aster burnishers and work ears.

These advantages have een accomplished by additons and rearrangement of echanical elements in resigning as follows:

(1) Cone worm drive, (2) Forced feed ubrication to all bearings. (3) Comined timing and reversing mechanism. 4) Horizontal mounting of master burishing gears. (5) Taper roller bearngs (Timken) throughout. (6) Special Belt Drive. (7) Mechanism for quick- mounting master burnishers. (8) ore convenient hydraulic adjustment and control. (9) New dual push button control.

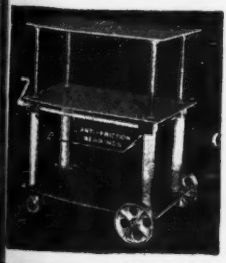
The new machine accepts gears within the size range of 1⅛ in. to 20 in. in diameter.

A new, wider and more rugged slide carrying two idler burnishers is fitted with a rapid screw adjustment for positioning. The upper bearing support for each of the two idler burnishers and

Cimatool Bolender Gear Burnisher

the master burnisher is mounted in a swing arm which permits easy access in change-over from one job to another. The work arbor has a rapid and fine adjustment provided for vertically positioning the gear to be burnished. Its lateral adjustment is accomplished with equal ease.

Operating pressure, that is the pressure between burnisher and work gear,



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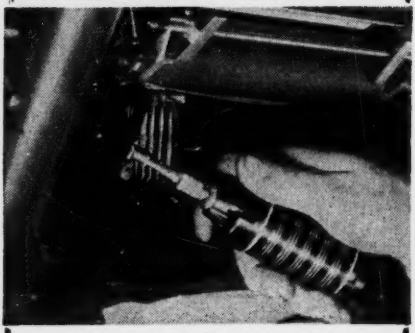

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M. M. S. 10

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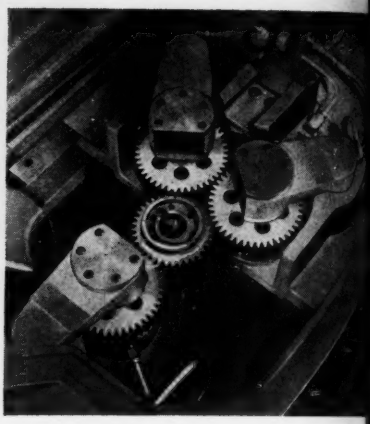
is easily controlled without the use separate tools. A dial pressure g shows the actual pressure between th gears at all times. Because of the sp cial V-belt drive, speed changes a easily and quickly attained.

Four large louvred doors provide ad quate cooling of motors, pumps, an piping, all of which is totally enclo and protected within the base of t machine. The in-built coolant reserv is easily accessible and may be clean out simply by removing one of the sna on doors.

A conveniently designed cover provid



Cimatool Bolender Gear Burnishing Mechani in Operation

adequate space for loading and unlo ing the machine and at the same ti prevents the coolant from splashing o

A sight gage informs the operator at times of the exact level and flow of l bricant in the drive compartment. Du push button control provides maximu safety.

Partool 8-Spindle Horizontal Rotary Lathe

Partool Machine Company, 91 Schaefer Highway, Detroit, Mich., h just completed the special 8-spin rotary horizontal lathe shown in illustration. The base is of fabricat steel, 93 in. in diameter. Upon this b is mounted a large anti-friction b bearing which carries the large 8-spin head, assuring smooth operating mo ment.

Spindles can be arranged either w

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We haven't, and we don't believe there is any. Our experience in building multiple V-Belt drives covers the whole range from ¼ hp. to 2000 hp. The engineering refinement necessary to build a ¼ hp. drive, and the engineering ability and manufacturing facilities necessary to build a 2000 hp. drive, combine into a diversified breadth of experience which is built into every Texrope Drive.
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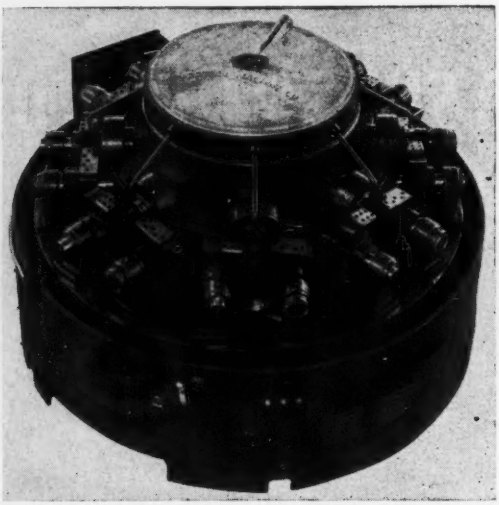

Partool 8-Spindle Horizontal Rotary Lathe

plain or anti-friction bearings to suit condition of work which it is required to perform; the tool blocks are mounted on large diameter shafts t assure rigidity and are cam actuated. The work holders a designed to automatically clamp the part before machin ing and unclamp the part aft machining.

This particular machine w designed to machine univers joint flange bodies, and opera at 900 cycles an hour. All re ciprocating parts have force feed lubrication from one cen tral oiling system. The coolan is pumped up into the reser voir located on the top of th machine which feeds coolan to the work in ample quantit There is ample provision mad for removing the chips; as th machine revolves they ar dumped out the rear of th machine into a container.

Weight—16,000 pounds.

Hisey Two-Wheel Wet Grinder

The Hisey Two-Wheel Wet Grind made by The Hisey-Wolf Machine Co Cincinnati, Ohio, and illustrated her

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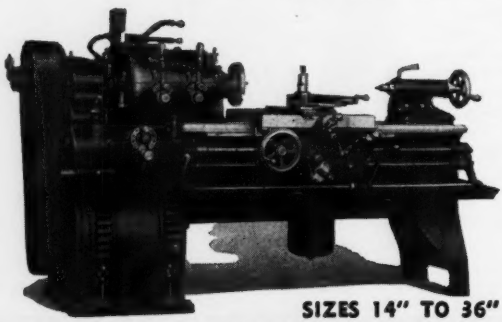
in your **BOYE & EMMES LATHE**



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CINCINNATI OHIO

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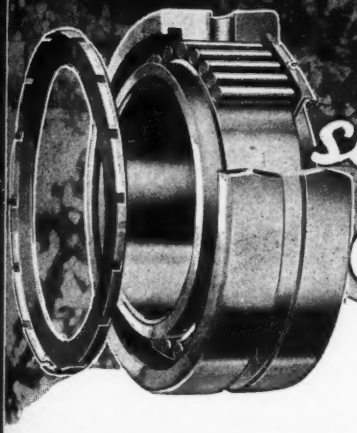

Like the sturdy oak, McGILL *MULTIROL* Bearings stand up under strains and stresses long after ordinary bearings have given way. They are unequalled for great load capacity in small radial space, and often can be interchanged with plain bearings . . . especially under sustained heavy or intermittent shock loads.

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with, is made in three sizes for 10, 12 and 14-in. wheels. The machine is designed to use motors of any electrical characteristics. Through the use of the V-belt drive, the correct spindle speed is always available and can easily be changed when desired. Provision is made for supplying a constant stream of coolant direct to the work.

Hisey Two-Wheel Wet Grinder

The advantage of a wet grinder of this type is the elimination of dust, which makes for healthier working conditions and saves the cost of a dust collecting system due to the fact that the stream of water carries with it all dust and grit. A separator removes all grit, however, before returning the water to the reservoir. The flow of water is controlled by a convenient valve on the top of the guard. The separator is easily removed for cleaning. The pump is self-priming and is driven by a V-belt from the spindle.

Model 10A Reed-Prentice Plastic Injection Molding Machine

The illustration shows the new Model 10A Reed-Prentice Plastic Injection Molding Machine which has been brought out by Reed-Prentice Corporation, Worcester, Mass. In designing this machine, a number of improvements have been included such as improved timing units and location of timers, push buttons and dial for easier operation. A shut off valve is supplied for the oil gages. The valves will be closed and opened only when checking the pressure. The push button station has been relocated and redesigned with a selector switch and dials for single cycle or automatic operation. Pilot valve levers now have a safety mechanism which eliminates danger of accidentally operating the machine.

The stationary die plate is cut from solid steel plate and the thickness has been increased to 4⅞ in. The movable die plate has been increased in thickness to 4½ in. Improved ribbing of the die plate and longer bearing on the tie bars of 10¼ in. is regularly furnished. The plate is equipped with a bronze

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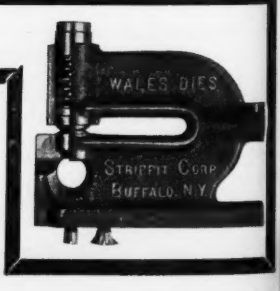

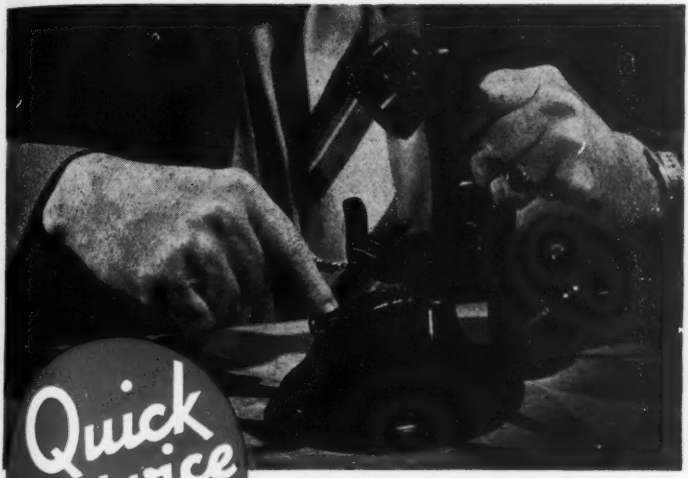

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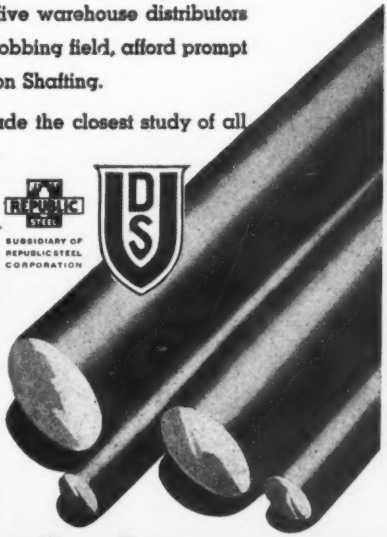


UNION DRAWN STEEL CO.

MASSILLON, OHIO

MEMBER OF POWER TRANSMISSION COUNCIL

Union Cold Finished Shafting

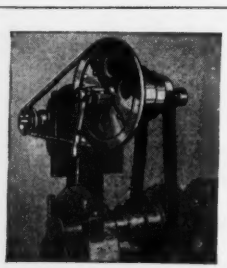
to give greater capacity. The unit is longer, of same diameter and the torpedo has circular holes rather than slotted holes, eliminating the trouble of light colors lodging in the corners and burning. The machine is also equipped with a heating unit on the nozzle that can be shut off when the machine is functioning, eliminating trouble due to material solidifying in the nozzle. Timing controls with dials have been improved with larger capacity rotors in the timers for more dependable operation. The machine is also equipped with a Nitraloy material plunger and a Nitraloy sleeve in the plunger cylinder, eliminating possibility of scoring. The pump, which is of larger capacity than heretofore, only requires 15 h.p. for a period of two seconds during the injection cycle. For the rest of the complete machine cycle, only an average of 7½ h.p. is necessary to operate the pump.

Shaw Model M Printer

Shaw Model M Printer

The Shaw Model M Printer illustrated herewith has been designed and built by Shaw Blue Print Machine Co., Inc., 11 Campbell St., Newark, N. J., to meet the demands for high speed in reproducing blue prints or black and white prints. The features of the machine are speed and economy. The printing speed of the machine can be varied within a range of from 9 in. to 12 ft. per minute. The machine employs only three arc lamps of high actinic rays, using ½x9-in. carbons. Globes are of pyrex. The lamps are designed so that the arcs will burn steadily for over 45 minutes before breaking and require trimming only every eight hours of continuous burning.

The frame of the machine is of all steel arc welded construction and is housed as shown with heavy sheet steel. The housing finish is olive green wrinkle, which is lasting and pleasing in appearance.



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THIS 5 FOOT 8 INCH FIRTHITE CUTTER

HAS 64 FIRTHITE BLADES

"HOLLYWOOD" superlatives are required to properly describe this truly huge Ingersoll Milling Cutter which is equipped with 64 FIRTHITE tipped inserted blades. This is probably the largest Carbide Tipped face milling cutter ever assembled. Its outside diameter is 68 inches and it slabs aluminum ingots up to 66 inches wide. A 150 H.P motor drives it at *3000 ft. per minute*. Removing *3/16" of stock* per pass at feed rates up to *72" per minute*. 60 blades do the roughing while 4 blades set 90 degrees apart and ahead on the face on a smaller diameter do the finishing. These 4 finishing blades have wide faced FIRTHITE tipped cutting edges to sweep the milled surface smooth and flat to prepare the ingot for the subsequent rolling and drawing operations.

This cutter effectually proves that size imposes no limitation on the use of FIRTHITE Sintered Carbide tipped tools. FIRTHITE helped make this unusual application possible. FIRTHITE also helps to make all cutting tools from single point turning tools to intricate fluted types more efficient and durable.

Write for price list giving new lower prices on tools, bits and tips.

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McKEESPORT PA.

The machine is powered with a ¼ h.p., 1750 r.p.m. constant speed motor. An infinite variety of speeds is available through the use of a special Reeves Variable Speed Drive and Control. A special shift lever, convenient to the operator at the front of the machine, provides two speeds: high, low and neutral. Individual switches for each lamp, motor and fan are on the left side of the machine. A start and stop switch is also located at the right side of the machine within easy reach of the operator and the speed control with speed indicator for setting at the speed required is also located at this side of the machine. An asbestos curtain serves an additional light shield to further assist in controlling light exposure. Lamps are cooled by a fan mounted on the left side of the machine.

The contact glass is curved in a semicircle providing a printing area 11x48 in. in size, which is ample to care for 42-in. tracings. The contact glass is sulphur free and clear white, and will pass 20 per cent more actinic ray than ordinary place glass. The glass can easily be swung into position for cleaning.

The feeding table is 18 in. wide. A foot treadle located at the front of the machine permits the operator to release tension on the endless canvas band so that a tracing may be withdrawn if desired. The band is quickly adjusted for creep by simple adjustment on the roller. The tension on the band is maintained at all times by a specially designed lever and heavy spring arrangement. Oilite bearings are used on all shaft and bearing points, in addition to which an oil cup is provided at each bearing, making it necessary to lubricate the equipment only once a year. The reduction gear unit is housed and runs in oil. The 42-in. machine is 65 in. wide, 41½ in. deep and 67 in. high, and weighs approximately 650 lbs. Machines of 54-in. sizes can be built on special order.

Linley High Speed Vertical Bench Milling Machine

For use in the making of dies, fixtures, patterns, tools, molds, and other similar work of a precision type, the high speed vertical bench milling machine shown in the illustration has been brought out by Linley Brothers Co., 583 Fairfield Ave., Bridgeport, Conn. The machine has been designed for the maximum flexi-

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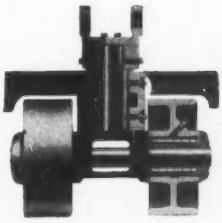

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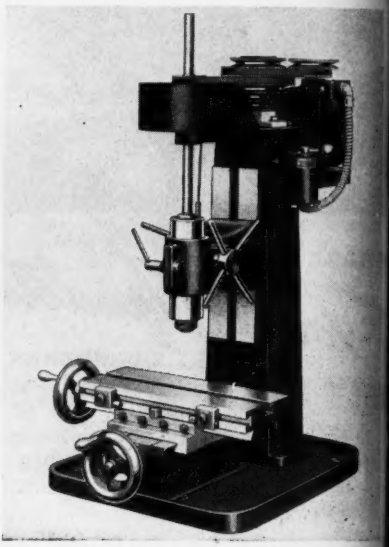
bility and accuracy and each machine is thoroughly tested before shipment.

The working surface of the table is 14½x5½ in. and has a ½-in. T-slot through the center. The longitudinal travel of the table is 10 in. and the cross travel is 5 in. Table, saddle and bed ways are hand scraped and securely gibbed for extreme accuracy and rigidity. The screws are fitted with replaceable bronze nuts and are equipped with large dials graduated in thousandths. An adjustable stop gage is provided for longitudinal adjustment and the saddle can be locked in position.



Linley High Speed Vertical Bench Milling Machine

The spindle has a vertical travel of 3 in. and can be locked for milling operations. The spindle is equipped with Norma-Hoffman Litro Ultra-Precision Preloaded Ball Bearings of ample size for long wear, and the spindle pulley runs on separate ball bearings. V-type belts are used on a compound drive which gives eight spindle speeds of 275, 430, 550, 860, 1250, 2125, 2500 and 4200 r.p.m. The intermediate pulley runs on ball bearings and is adjustable for belt take-up. The spindle is designed for collets which can be furnished in sizes up to and including ½-in. to take small straight shank mills. A special collet is furnished for No. 5 B & S taper shank

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is being consumed this year. The consumers have shifted to MO-MAX for quality and quantity production because they have found it makes better tools. These facts prove that MO-MAX has established itself as a superior high speed steel. Its use in the plants of consumers has demonstrated that—

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- MO-MAX is easy to grind
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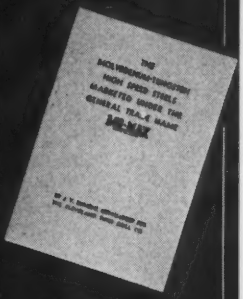
- MO-MAX tools are tougher
- MO-MAX tools have superior cutting quality

Leading steel companies in North America and Europe are now licensed to make MO-MAX. A booklet giving the essential data may be obtained by addressing The Cleveland Twist Drill Company, Cleveland, Ohio



Swift to MO-MAX for Quality and Quantity Production

MO-MAX is a proprietary name owned and controlled by The Cleveland Twist Drill Company and its only licensed use by others is on steel made and sold by licensees under U. S. Patent Nos. 1,937,334, 1,998,953, 1,998,954, 1,998,955, 1,998,956, 1,998,957, and Canadian Patent Nos. 346,506, 364,032 and 364,033.

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SALES OF MO-MAX BY 3 MONTH PERIODS

The sliding head has a movement of 8-in. and in an upper position allows 11 in. between the spindle end and the table top. The motor is mounted on an adjustable bracket to allow for belt take-up and a reversing switch is provided to operate the motor in either direction for right and left hand mills. Standard equipment includes a ⅓ h.p., 1725 r.p.m. ball bearing motor, either single phase, 60 cycle, 110 or 220 volt, or three phase, 50 or 60 cycle, 220 volt. Also included are a reversing switch, belts, one collet of any specified size up to ½-in. capacity, and one special collet for No. 5 B & S taper shank. Shipping weight, 300 pounds.

Motors having other characteristics can also be furnished, also foot treadle equipment for operation of quill travel can be supplied upon special order.

Jarvis Vario-Flex Flexible Shaft Machine

The line of flexible shaft machines built by The Charles L. Jarvis Company, Middletown, Conn., has been augmented by the addition of the "Jarvis Vario-Flex", illustrated herewith. The feature of this machine is that the surface speed of the grinding wheels can be maintained as the wheels wear down, due to the fact that from 12 to 14 instant speed changes are available without stopping the machine.

Jarvis Vario-Flex Flexible Shaft Machine

The machine is powered by a totally-enclosed ball bearing motor mounted on a heavy duty cast iron base with large rubber-tired ball bearing wheels. The

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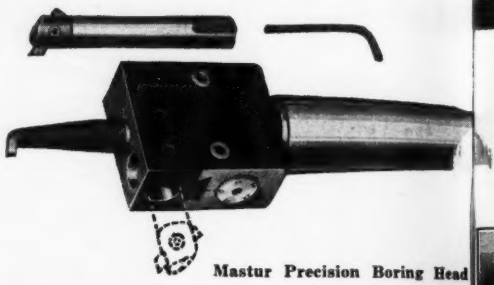
MACHINED AND CENTERED BRONZE BARS
BABBITT METALS

motor can be swiveled to any point in the complete 360 deg. circle. The shaft is equipped with a heavy duty handpiece with two double-row ball bearings.

The machine is made in three sizes: 1, 1½ and 2 h.p. to deliver speeds of 2200 to 4700, 2000 to 4500, and 2000 to 4500. The two smaller sizes have ¾-in. diameter spindles and the large machine has a 1-in. diameter spindle.

Mastur Precision Boring Head

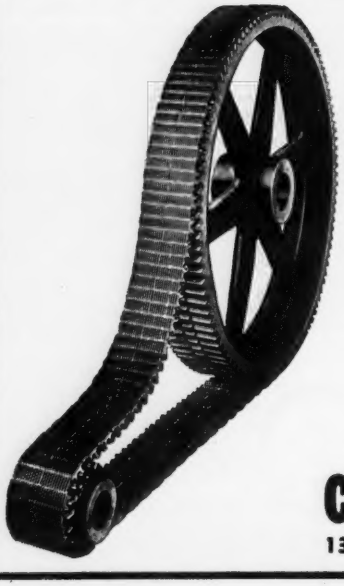
The Mastur Precision Boring Head, product of P. A. Maxwell Company, Bedford, Ohio, is small, compact and rigid, but, due to the construction, has exceptionally large boring capacity. The block and body are of alloy steel, heat treated. The tool block is dovetailed into the body on a 30 deg. angle. All parts are ground. The body of the tool is split between the tool block and the adjusting screw hole, making it possible, through the medium of two lock screws, to obtain any degree of tension on the dovetail slide. The adjusting screw and nut are of tool s
The screw head is graduated in 50 di
ions, providing for reading in th
sandths of an inch on the screw he



Mastur Precision Boring Head

while the body is graduated to prov
a vernier reading in two ten-th
sandths of an inch. Perfect alignm
is a feature of the tool, there being
gib. Every working part is adjustabl
wear.

The tool is made in three sizes, 1
cated as Nos. 5, 6 and 7. The No
is 7-in. capacity, the No. 6 is 11-
capacity, and the No. 7 is 15-in. capac



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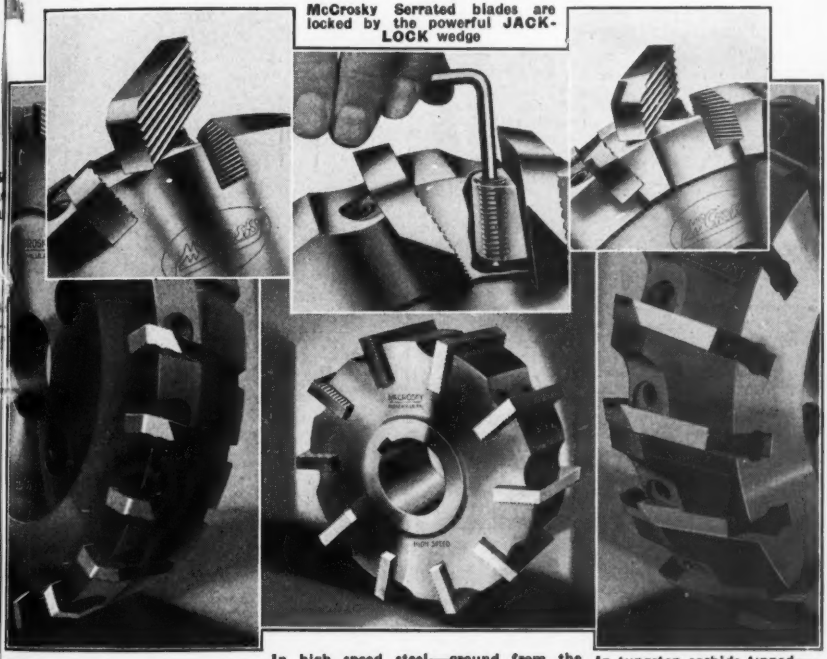
McCROSKY

Tru-Ground

SERRATIONS

GROUND FROM THE SOLID

A new feature in blades for JACK-LOCK tools



McCrosky Serrated blades are locked by the powerful JACK-LOCK wedge

In Stellite—ground from the solid

In high speed steel—ground from the solid after hardening

In tungsten carbide tipped—ground from the solid after brazing

McCROSKY TRU-GROUND Serrations produce an improved design of blade that meshes more perfectly with body serrations and adjusts more easily. Each alternate tooth in the blade is omitted, but no teeth are omitted from the slot serrations (compare blade and slot serrations shown above). By the TRU-GROUND method truer serrations can be ground in Stellite at reduced cost; warpage of serrations in high speed steel is eliminated; tungsten carbide tipped blades are locked more rigidly. TRU-GROUND Serrations are used exclusively in McCrosky JACK-LOCK milling cutters and special-purpose serrated tools. Ask for Bulletin No. 16-A.

The design of McCrosky TRU-GROUND Serrations and the method of producing them are covered by patent applications.

McCrosky Tool Corporation, Meadville, Pa.

Sales Offices: Chicago, Cleveland, Detroit, New York, Philadelphia

3 NEW VALVE GRINDING COMPOUNDS

FROM a varied line of scientifically made SPECIAL Valve Grinding Compounds developed originally for individual mfgrs. of R.R. Rotary & Slide Valves, Diesel, Automotive, Refrigerating equipment, R.R. & Motor Bus Air Brake Valves, we invite your attention to 3 grades of compounds that are expressly made for the grinding of Angle Cock and other types of Cock Valves; both new and reconditioning grinding.

A SPECIAL Compound for Angle Cock & Brass Cock Valves

Grade No. 19—A water soluble base that has all of the lubrication of grease and oil compositions, and contains a filler to prevent "Niggarding or Scoring" during the grinding operation. It contains the abrasive that exhaustive tests have shown to be best suited for the grinding of Brass and Bronze keys in brass bodies and Bronze keys in cast iron bodies. Made especially for washing with cold water after the grinding operation.

A SPECIAL Compound for Cast Iron and Steel Cock Valves

Grade No. 350—An oil soluble base containing the proper abrasive for grinding Cock Valves of Cast Iron, Steel and Stainless Steel.

A Roughing grade for Cast Iron and Steel Cock Valves

Grade No. 275—The original grinding and reconditioning of large steel and Iron Cock Valves often requires a coarse or roughing grade of compound for correcting degree of taper, etc., before using a finer grade for final lapping operation. Grade No. 350 is well recommended for this final lapping operation.

TRY THEM — A quart sample sent free upon request

United States Products Co.

Abrasive Engineers - - Specialists in Gear Lapping and Valve Grinding

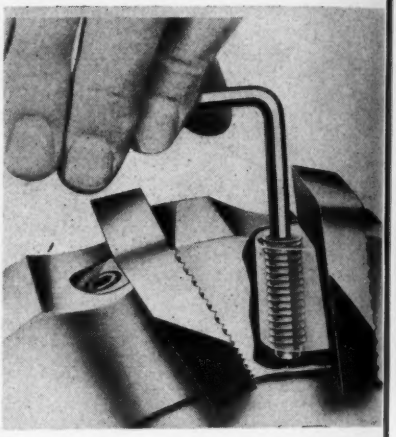
728 Filbert St. Pittsburgh, Pa.

MACHINE LAPPING - PLATE LAPPING INTERNAL LAPPING

Serrated Blades with McCrosky Tru-Ground Serrations

A serrated blade with serrations ground from the solid instead of hobbed is announced by McCrosky Tool Corporation, Meadville, Pa., for use in inserted serrated blade tools.

Serrating by grinding has always been the only possible method for an unmachineable alloy like Carboloy, but this method has been too difficult and expensive to be practical for use on high speed steel blades. Only one serration could be ground at a time, and the grinding wheel had to be dressed often to maintain the sharp V form and to produce uniform angle and pitch.



McCrosky Tru-Ground Serrations in a High Speed Steel Blade Showing Phantom View of McCrosky Jack-Lock Wedge

To overcome these manufacturing difficulties, McCrosky has developed a new form of serration and a new method of grinding serrations. The main principle of the development is to avoid the sharp V form of grinding wheel necessary to produce the sharp V form of groove between two adjacent teeth in the conventional type of hobbed serrations. This has been accomplished by omitting every alternate tooth. The resulting McCrosky serration pattern has a flat-bottomed groove between the teeth that does away entirely with the sharp V ridge on the periphery of the grinding wheel. The McCrosky method also permits a series of serrations to be ground at one time.

Omitting every other tooth in the blade does not change the adjusting in-

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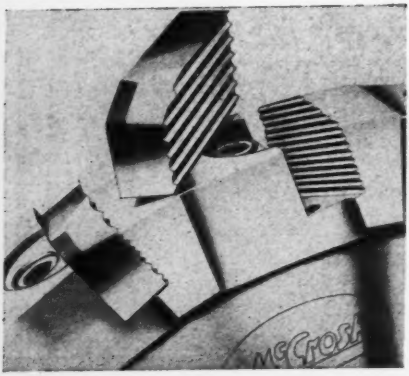


McCrosky Tru-Ground Serrations in Tungsten Carbide Tipped Blades

crements of the assembled tool. No teeth are omitted from the table slot, and the blade can therefore be moved out from one serration to another as in the tool with conventional blade serrations. The accompanying illustrations show the relation of McCrosky blade and body serrations. The smoothly ground, accurate serrations on the blade quickly find their mating serrations in the slot and save time in assembly or adjustment.

McCrosky Tru-Ground Serrations offer particular advantages for high speed steel blades. By the conventional hobbing method serrations are generated in the soft high speed blade blank before hardening. The hardening process tends to warp the blade and scale the serrations. The result is an imperfect meshing of blade serrations in slot serrations and therefore a poor bearing. McCrosky Tru-Ground serrations eliminate this danger completely because serrations are ground from the solid after hardening.

Applied to Stellite, the McCrosky design and method produce truer and more uniform serrations at less cost than by the slower method of grinding one serration at a time. Applied to blades tipped with tungsten carbide, the McCrosky principle insures greater rigidity in the assembled tool by providing a perfect bearing between the blade and body serrations.

Blades with McCrosky Tru-Ground Serrations will be used exclusively in McCrosky Jack-Lock Milling Cutters and special purpose tools. The design of

IT'S PRECISION 'BUILT

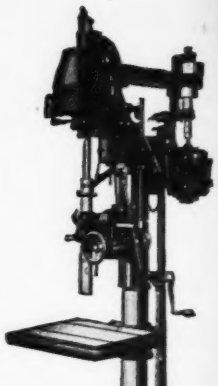
.the C-O 21" Sliding Head Drill

Here's a typically accurate, flexible, yet larger C-O Drilling Unit for high production drilling of large holes. Self-feed and back gear attachments provide a wide range of speeds and feeds.

Vertical Motor Drive—eliminates unnecessary pulleys, idlers, twist and turn belts, reducing wear and vibration; cone pulleys are dynamically balanced, a flexible coupling inserted removes vibration in the drive shaft. Two Timken Roller Bearings in the Spindle Quill at the top and bottom, provided with a screw adjusting collar for take up. Annular ball bearing in the motor cone pulley, and ball bearing motors. Positive type power feed is controlled by a push knob.

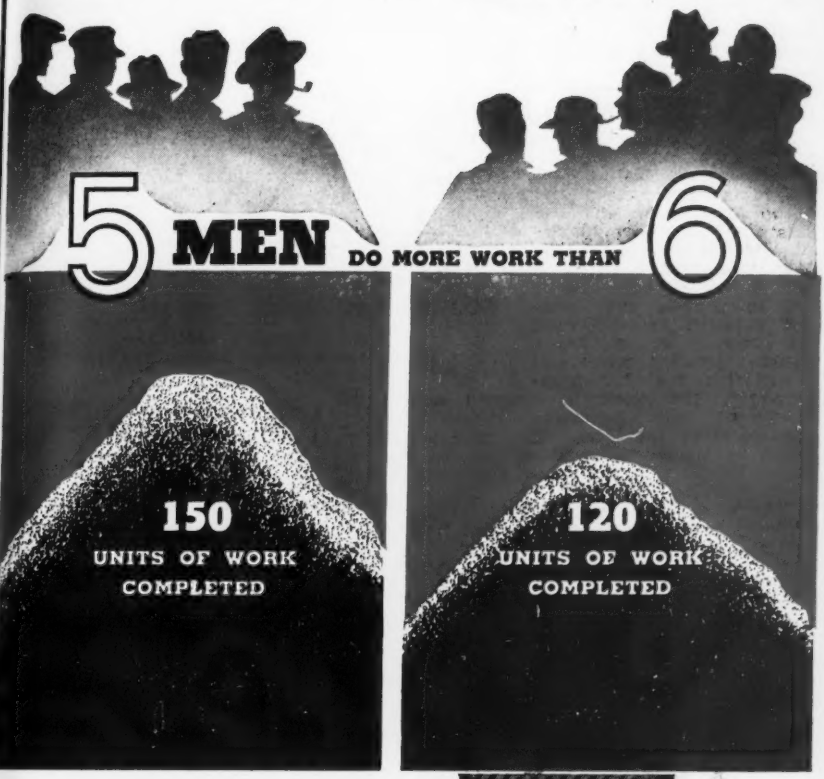
Canedy-Otto Drills are always "Ready For The Job".

Write for illustrated circular giving complete details.



CANEDY-OTTO MFG. CO.

CHICAGO HEIGHTS ILLINOIS



Five expert filers completing 150 units of work while six filers, just as expert, finish only 120!

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The demonstrated ability of Nicholson, Black Diamond and McCaffrey Files to remove more metal is an important reason for using them . . . *especially now when statistics indicate that for every six jobs requiring expert filers there are only five men to be found.*

These three leading brands not only cut faster. They are uniformly high in quality and cost less to use. Set them to work in your plant. Your mill supply dealer can meet your needs promptly. Nicholson File Company, Providence, R. I., U. S. A.

A FILE FOR EVERY PURPOSE

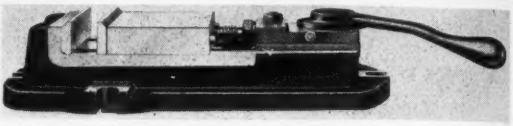
McCrosky serrations and the process of producing them are covered by patent applications.

Brown & Sharpe No. 2C Cam Vise

The time required to clamp work in a vise on a milling machine, drill press or shaper table, can be reduced to the minimum by the use of the Brown & Sharpe Cam Vise illustrated herewith, product of Brown & Sharpe Mfg. Co., Providence, R. I. The movable body can be set to provide the opening required for the work by means of a heavy square threaded screw and nut. With the jaw properly set, the work is clamped and unclamped by a simple, short horizontal movement of the lever. The force applied by the lever is multiplied many times by the cam, imparting a powerful clamping force.

The movable body is gibbed to the slide by straps which are protected from chips and dirt. The fixed jaw is a one-piece semi-steel casting. Jaws and other steel parts subject to wear are hardened and ground and the jaws are interchangeable. The bearing surface extends the full width of the vise body, permitting work to withstand the pressure of the cut at the extreme ends of the jaws with the least tendency to pivot or shift vertically.

Tongue slots at right angles permit the vise to be set either lengthwise or at right angles to the table. A reversible tongue is provided for either $\frac{11}{16}$ or $\frac{13}{16}$-in. slots. The jaws are $5\frac{1}{8}$ in. wide, $1\frac{1}{4}$ in. deep, and open 2 in. Weight, 42 pounds.



Brown & Sharpe No. 2C Cam Vise

Barber-Colman Type S Automatic Hobbing Machine

For the high speed continuous hobbing of spur gears and pinions of the type used in small precision instruments, Barber-Colman Company, Rock-

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The Pump that Pays a Profit

When you buy a coolant pump you look for quiet, uninterrupted and economical service. That's smart buying.

The ball bearing design of the Ruthman "GUSHER" Pump minimizes friction and increases efficiency—to give you maximum service.

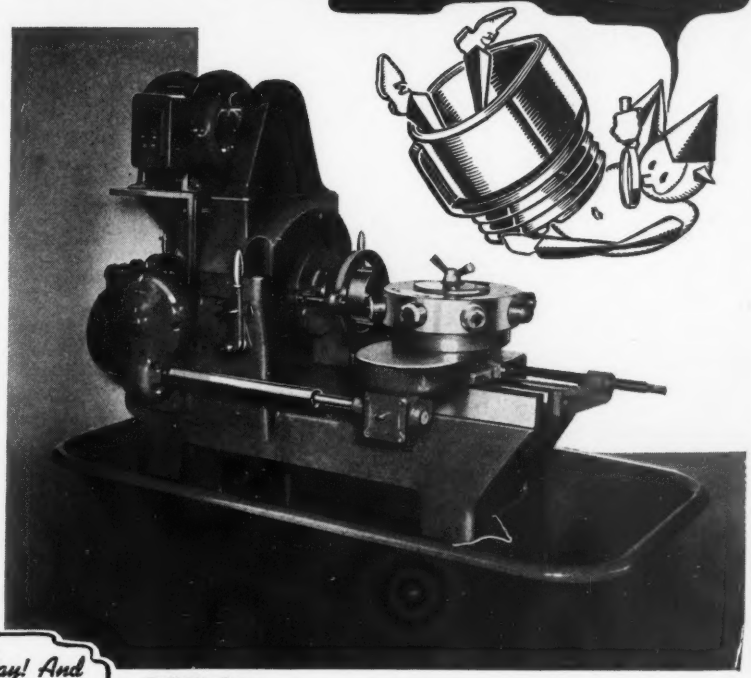
Write for further details on the "GUSHER"—the pump that pays a profit.

GUSHER COOLANT PUMP

The RUTHMAN MACHINERY Co.

538 EAST FRONT STREET CINCINNATI OHIO

Oh Lead! Was this a tough baby to thread —very difficult to hold



I'll Say! And we gave them 1200 threaded pieces per machine every hour. That's production, Pitch, old boy!

PITCH has his glass on a little electrical connector. A few months ago it was just a problem—a sample sent to R & S Machine Designers. Today it's just one of 1200 threaded pieces per hour.

The R & S Threading Machine that spits out threaded connectors is automatically indexing, manually loaded and cam controlled. The cam controls the pitch.

Mail your production threading problem in the form of a sample piece—give us thread specifications and data and we'll give you production plus. Let's have it folks.

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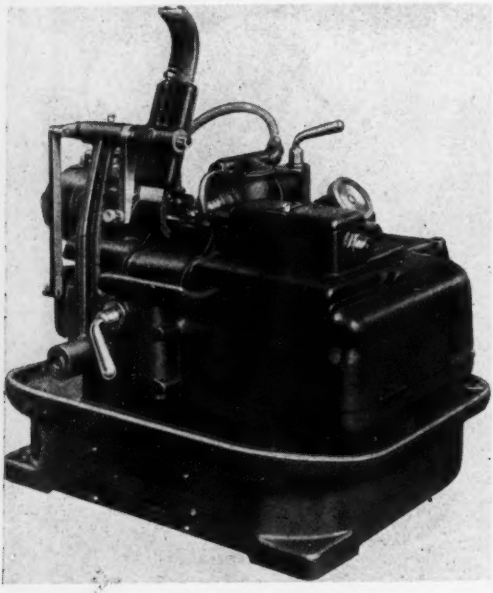
Adjustable Boring Heads; Collapsible Taps
Solid Adjustable Die Heads; Chasers;
Self Opening Die Heads; Solid Adjustable Taps

Tapping Machines; Automatic Cut-off Machines;
Automatic, Single Purpose
Threading Machines

ford, Ill., has developed an automatic hobbing machine to be known as the Type S. The machine will hob spur gears and pinions or similar work up to 1-in. diameter by ½-in. face.



Barber-Colman Type S Automatic Hobbing Machine

The automatic cycle of the Type S machine includes work loading, rapid approach to the hob, feed, quick return, ejection of work, and repeat. The machine is easy to set up and after once being set, the operator merely keeps the magazine loaded. The machine can, however, be hand loaded and operated as a single cycle machine. Adjustments for variations in work are said to be few and simple.

The base is of sturdy, modern design and is built integral with an apron to catch coolant and chips. The machine can be supplied for bench installation or with pedestal for single installation, or base for battery of units. The tail spindle is spring-loaded and is in precise alignment with the work spindle. It automatically withdraws at the end of each cycle to release the work, then advances, moving a new workpiece from the magazine into the driving spindle. The heat treated and ground work spindle is tapered at the nose for sleeves, collets or bushings.

The cam-operated magazine automatically presents the work-piece to the spindle and holds enough blanks to allow the operator to service other machines.

The hob spindle can be adjusted quickly and accurately to the lead angle of the hob by means of graduations and a vernier. A quick-acting clamp locks the spindle solidly. A knurled disk and dial with accurate, easy-to-read graduations facilitate adjustment of the hob spindle for work of different diameters. A compression spring for work loading assures continuous reliable operation.

Change gears for index and feed are completely enclosed in a compartment with hinged cover. Compound index change gearing provides a wide and closely integrated range of ratios. Vertical adjustment of the hob is maintained positively by quick-acting clamp

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Strand
MV4
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Of High Quality Only
⅛ to 2 H. P.
VERTICAL AND HORIZONTAL
It Pays To Buy The Best
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THIS JOB IS *A NATURAL* FOR STARRETT SHOP EQUIPMENT TOOLS

YOU CAN GUESS

how much inspection work it takes before this baby gets a final O.K. This shop makes every measurement with Starrett Tools. The men have confidence. They work better and *faster*. And costly dies are rarely spoiled.

A PERFECT FIT!

Layed out, produced and inspected with the aid of Starrett Tools, dies like this come through well within close limits. Shops that do this kind of work almost invariably specify Starrett when they buy Precision Shop Equipment Tools.

WRITE for Revised Starrett Catalog No. 25MD. It describes the complete line of Starrett Precision Tools.

THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.

World's Greatest Toolmakers—Manufacturers of Hacksaws Unexcelled—Steel Tapes, Standard for Accuracy Dial Indicators for Every Requirement

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at the front of the machine. A worm gear meshing with a hardened and ground worm provides smooth, positive drive for the spindle. A feed cam governs the full automatic cycle including rapid approach of work to hob, feed and quick return.

A direct-driven pump floods every working part of the machine with a copious supply of lubricant. Coolant is circulated by a direct-driven gear pump which floods both the hob and the work. Machines arranged in batteries can be supplied with coolant from a central reservoir and pump. An automatic trip lever controls a one-revolution clutch that governs the work-handling mechanism. The switch is mounted on the motor for individual drive. A battery of machines can be driven from a single source of power.

The capacity of the machine, diameter, is 1 in. and the face is ½ in. Diametrical pitch brass, 24; steel, 32. Maximum travel of slide, 1 in. Hob diameter, minimum, ⅝ in.; maximum, ⅞ in. Hob speeds, minimum, 500 r.p.m.; maximum, 1500 r.p.m. Number of hob speeds with gears furnished, 19. Number of feeds per revolution of work 19. Bench space required, 24x26 in. Motor, single phase, ⅓ h.p., 1800 r.p.m. Weight, 340 pounds.

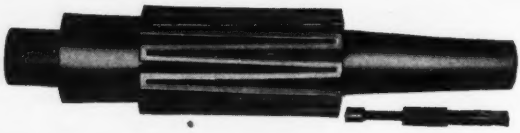
Landis Automatic Work Stop

The Landis Machine Company, Waynesboro, Pa., has designed an Automatic Work Stop for use on the Landmaco Threading Machine. The Automatic Work Stop may also be applied to all Landis standard threading machines employing a Model A carriage front.

The attachment may be used to excellent advantage where it is desired to locate stock in the same relative position for threading. It is particularly applicable to operations where the thread is close to a shoulder, and where thread length, for each piece, must be maintained. The work stop is fully automatic in its action and materially improves production as time is saved by its use, particularly if there is a number of similar pieces to be threaded. A bracket fastened to the end of the carriage front supports a horizontal shaft on which a stop arm is mounted. The stop arm is adjustable on the shaft for any distance up to the length of the carriage travel of the machine.

The end of the shaft nearest the operator is fitted with a pinion gear

Handiest tool in the plant



That's what you, too, will say about Knock-Out Expanding Mandrels. They are accurate, durable, inexpensive, and indispensable. Write for Bulletin M37B.

K. O. LEE & SON CO., Aberdeen, S. D.

YOU spend a lot of money to replace end mills.

The largest portion of this replacement cost is due to breakage and *not* to wear.

FALCON engineers, through intensive research, have produced an end mill which will withstand far greater stress than was hitherto thought possible.

Neither wearing qualities nor proper chip clearance have been sacrificed to obtain this rugged end mill.

Why not investigate this tool that will save you money? Write for catalog.

SAVE WITH FALCON CUTTING TOOLS

Other Falcon Products: Carbide tipped tools, single end taper shank and ball end mills, shell end mills, counterbores, reamers, milling cutters, arbors, holders, special tools, etc.

Valuable territories available for agents and dealers. Write for information.

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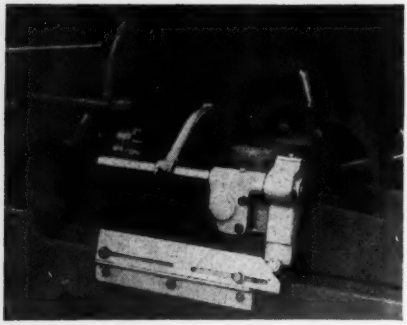

Landis Automatic Work Stop

that engages in a vertical rack gear. A cam fastened to the bed of the machine is used to actuate the movement of the stop arm as the carriage moves forward or backward. A roller on the end of the rack gear operates on the cam to reduce friction between the cam and the rack gear.

The cam has elongated slots that make it adjustable to any position. When the carriage is back or in position for loading and unloading, the stop arm is down. After the piece to be threaded is gripped in the vise, the cam is set so that the stop arm raises with the first forward movement of the carriage. This eliminates the possibility of the arm striking the head and causing any damage.

Rybeck Flexible Coupling

The T. L. Smith Company, 2831 North 32nd St., Milwaukee, Wis., is introducing a new type of coupling known as the Rybeck Flexible Coupling, which compensates for extreme conditions encountered in direct drives. The Rybeck Coupling is of full-floating, semi-universal joint design. The company claims it is the only one on the market that takes care of shaft misalignment, offset between shafts, end-play and shock, without increasing bearing loads. And it handles all four conditions even when present to an excessive degree.

According to the manufacturer, torsional load is transmitted through groups of laminated springs made of heat-treated Swedish spring steel. These springs are not subjected to any wear from endwise motion of the shafts, nor from angular or offset misalignment, since they are confined in a housing which eliminates any motion except de-

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Why did he make this voluntary statement? Why do others write us so enthusiastically of our services? Because our home study course of training makes better foremen, more efficient time study men, more valuable management officials, and thoroughly prepares other key men for future advancement in the organization.

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Fast as Lightning
NO VALVE known to engineering science can be opened or closed with greater speed than the poppet type valve. No valve performs its function with less friction and wear on the working parts. Ross poppet type, air control valves reduce operating efforts to a minimum, giving instant, lightning-like action.
Valve seats of synthetic, oil-resistant rubber assure perfect seal—no leakage—long life. Seal not affected by frictional wear. All ports on one face offer important mounting advantages and simplifies installation. Short throw makes Ross valves ideally suited for mechanical control. Install Ross valves for the operation of your air actuated equipment.
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THE BRIDLE FOR AIR HORSEPOWER
HAND CONTROL
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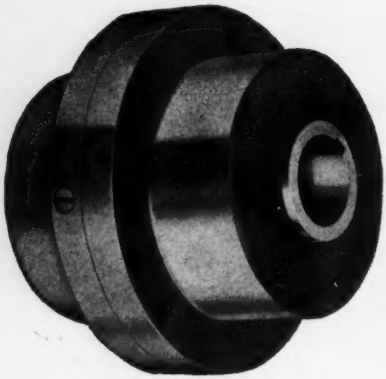
MECHANICAL CONTROL
A SIZE AND TYPE FOR EVERY OPERATION

flection. It is said the springs are stressed to only a fraction of their load carrying capacity.

Special alloy steel driving pins, heat-treated, are pressed into steel hubs and fit into holes drilled into the torque sleeves. The sleeves are heat-treated to great hardness and are held in alignment by the housing which is securely bolted together. The housing also holds the springs in position between the jaws on the torque sleeves.



Rybeck Flexible Coupling

U. S. Power Driven Straightener

The great savings in productive labor, material cost and stock waste made possible through the use of coiled stock have led many metal fabricating concerns to adopt this more modern method of buying material. To take full advantage of all possible economies in this connection, these manufacturers require special equipment to automatically handle the coils of stock. The U. S. Tool Company, Inc., Ampere, East Orange, N. J., manufactures a complete line of automatic press feeding equipment, stock reels, stock straighteners and coil cradles, to handle coiled stock from coil to finished part.

The latest addition to the U. S. Tool line is a power driven straightener for heavy coiled stock. This unit used in conjunction with the U. S. Automatic Coil Cradle and U. S. Slide Feed provides a means of automatically removing stock from heavy coils, straightening it, and feeding accurate lengths to the punch press. Among the exclusive

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U. S. No. 1 Anti-Friction Bearing

Hand Milling Machine

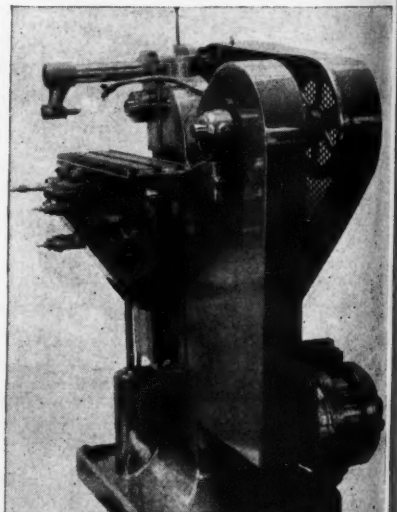
The New U. S. Hand Miller is particularly adapted to high speed light milling operations. Vertical and horizontal feeds.

Improvements: Heat treated chrome nickel steel spindle, Timken bearings, Ballbearing countershaft, V-belt drives, 6 Spindle Speeds up to 1592 R.P.M., providing efficient use of small end mills.

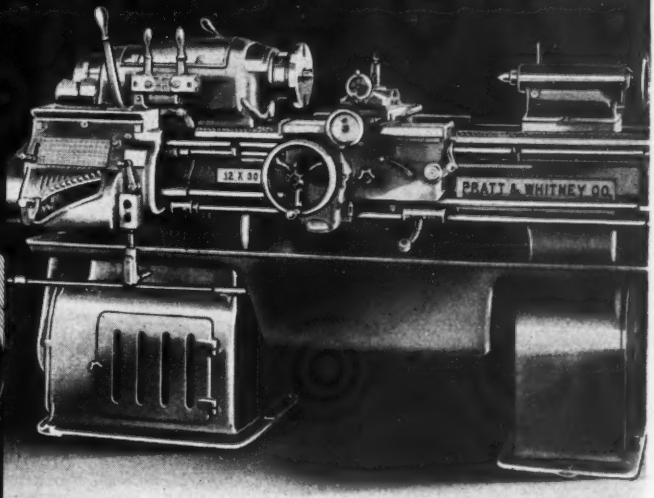
Write for full details.

The UNITED STATES MACHINE TOOL Co.

1954 W. 6th St. Cincinnati, Ohio



YOU *Must* CONSIDER TODAY'S TRENDS!



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AUTOMATICALLY *Correct* LUBRICATION

● **The Bijur Automatic Lubricating System is standard equipment on the most advanced machine types. Speeds stepped up . . . wider feed ranges . . . greater accuracy! Such machines MUST show low-cost operation per unit of output. This necessitates MAINTAINED accuracy . . . low maintenance expense. All assured by BIJUR lubrication—for sliding way surfaces as well as bearings! Investigate the wide range of Bijur use on up-to-date machines. Its economy, too. Write for Bulletin "D" on modern lubrication progress.**

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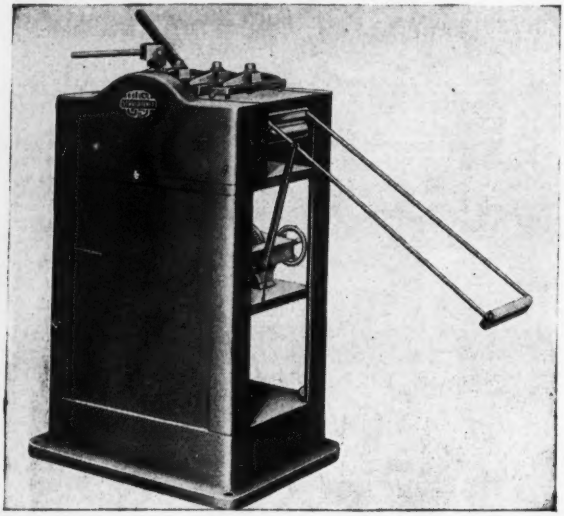
916

features of the U. S. Power Driven Straighteners are: (1) All rollers equipped with needle bearings. (2) Simple, automatic roll adjustment, rolls alalways parallel. (3) New coil of stock may be inserted without disturbing setting of straightening rolls. (4) Single movement of operating lever releases



U. S. Power-Driven Straightener for Coiled Stock

feed rolls to start new coil. (5) Can be used in conjunction with U. S. Plain Stock Straighteners for handling thin, springy material.

U. S. Power Driven Straighteners are built in a number of sizes to handle stock up to ¼ in. thick. Units can be furnished to handle any width stock. The straighteners are power driven, with variable speed drive. They are mercoid switch controlled and operate intermittently to synchronize with the punch press feeds.

"Production" Small Electric Counter

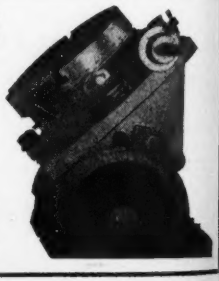
The Production Instrument Company 1325 South Wabash Ave., Chicago, Illinois, announces a new line of electrically-operated counters, adapted to economical built-in applications on a wide range of coin-operated machines, production machinery and similar equipment. The counter is unusually compact. The counter itself measures 1⅞x1½x1¾ in., and is mounted on a plate 2⅞ in. square. The operating relay is attached below the base plate and extends 1⅞ in. below the surface.

The counter is equipped with large, legible number wheels, and black figures on a white background. The lightweight, coined wheels require minimum driving effort, resulting in long-lived, dependable recording. There are no spaces between number wheels, an additional feature which contributes to legibility. Five number wheels give a capacity of 99,999, which is ample for all requirements in small counters. The operation relay actuates the lever arm of the counter, which has a throw of only ½ in. Positive and dependable action prevents skips or overthrow of number wheels.

ADJUSTABLE ANGLE TILTING TABLE

Suitable for adjustable angle machining by means of our 7½" Rotary Table, Vises or other holding fixtures.

Write for detailed description and price.



JOHN B. STEVENS INC.

306 HUDSON ST. NEW YORK CITY

"IT WOULD BE A TOUGH JOB

trying to grind this spline gage to the accuracy called for on the print without Johansson Gage Blocks."

● Thousands of toolmakers would say the same. For precision, they depend exclusively on

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GAGE BLOCKS AND ACCESSORIES

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Johansson Division **DEARBORN, MICHIGAN**

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files of precision

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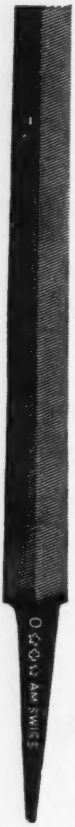

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THEY ASSURE LONGER AND BETTER FILING SERVICE THUS REDUCING FILING COST.

Over 2,000 regular Shapes, Cuts, and Sizes, enable you to have the exact file for the job.

Buy them from the nearest distributor.

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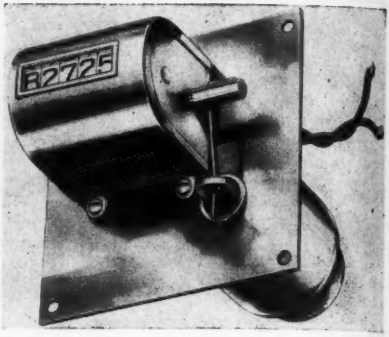


"Production" Small Electric Counter

The case enclosing the counter mechanism is of steel, designed to afford full protection to working parts. Since the case cover is fastened at the bottom, and Type SEC electric counter is a non-reset instrument, simple, tamper-proof installation may easily be made.

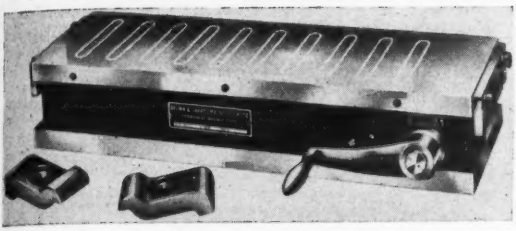
Brown & Sharpe Permanent Magnet Type Magnetic Chuck

Brown & Sharpe Mfg. Co., Providence, R. I., is now marketing (only in the United States) a magnetic chuck of the permanent magnet type as shown in the illustration. The feature of the chuck consists in that it requires no electrical connections, no wires, switches, auxiliary generators, or current supply. The chuck is entirely self-contained.

Magnets used in this chuck are of a special alloy and maintain several times more energy than permanent magnets previously available. The working surface and base are ground parallel and at right angles to the back. Both the ends and back are provided with removable stop plates which can be adjusted vertically to suit the requirements of various jobs. Moving parts are equipped with greaseless bearings.

The magnetic flux is controlled by the simple movement of a crank which changes the position of the magnets relative to the top of the plate so that work is either held or released. Work placed on the working surface is securely held when the crank is in the "on" position, and is released by a simple 180 deg. movement of the crank to the "off" position.

The chuck is well adapted for wet as well as dry grinding as it is completely sealed so that coolant cannot enter the



Brown & Sharpe Permanent Magnet Type Magnetic Chuck

internal parts. There is no external insulation to deteriorate from exposure to oil and coolant. The chuck is readily portable and is very useful as a bench tool for holding either small thin pieces or large pieces for polishing and similar jobs. The chuck is made in two sizes: the No. 510, which has a working surface of 5⅝x10⅜ in., and the No. 618, which has a working surface of 6⅜x18⅛ in. The base dimensions are, respectively, 5⅝x11⅞ and 6⅜x18⅛ in.

Century Fractional Horse Power Motors

The Century Electric Company, St. Louis, Missouri, announces a new complete line of fractional horsepower motors in sizes from 1/6 to ¾ horse-power repulsion start induction, single phase, split phase, capacitor, polyphase and direct current.

This line is designed with interchangeable mounting dimensions for a given horse power size.

The fundamental principles are the same as have been used by Century for many years, but many improvements have been added which can be appreciated only by inspection.

Bijur Lubrication Feed-Line Connection for Tight Places

An ingenious new type of tubing joint —the Bijur Drive Bushing Connection— has been devised by the Bijur Lubricating Corporation, Long Island City, N. Y. It provides efficient tubing connections on lubrication feed lines to bearings where space is very limited, and there is insufficient room for any type of threaded nut or conventional bushing.

The small tapered brass bushing em-

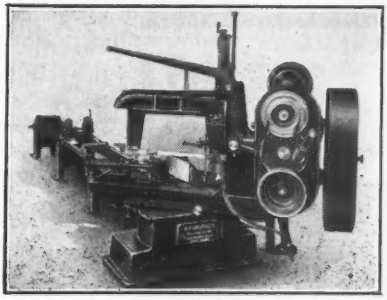
THE NEWEST DEVELOPMENT IN

METAL CUTTING MACHINES

FULL AUTOMATIC—CAPACITY 10"x10" & 6"x6"

Stops when desired number of pieces have been cut. Length of cut is gauged by scale without end stop. Swivels on base for angular cutting.

Also built for manual operation.



RASMUSSEN MACHINE CO.

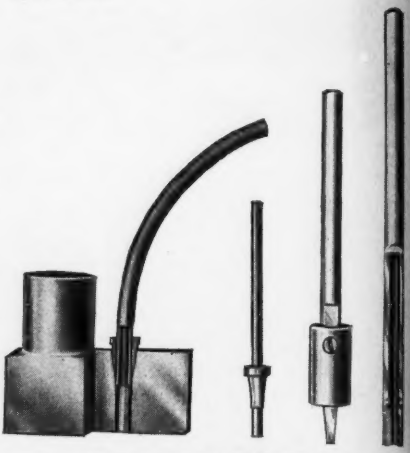
RACINE, WIS.

Send for circulars giving complete information.

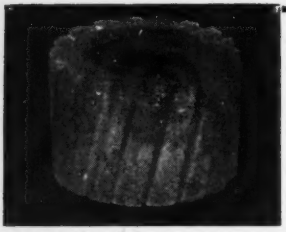
ployed in this special connection has a center hole to slide readily over the particular size of the tubing used. This bushing is mounted into a shallow hole which is taper reamed. In the assembly operation, the drive bushing is placed into the mounting hole and the tube inserted as far as possible. Then, by means of a simple drive tool, one or two blows with a hammer will drive the bushing home. The taper fit causes the bushing to grip the tubing tightly and make an oil-tight and dirt-proof joint.

While adapted especially for use on lubrication feed lines of quite small mechanical units, the Drive Bushing Connection can be used in combination with any of the standard types of Bijur Automatic Lubricators and Meter-Units, in their various applications. It not only lends itself to the Bijur standardized equipment requirement of neat and compact production installation, but also bears out one of the most important features of the Bijur automatic lubricating systems; namely, an enclosed system from oil reservoir to bearings—the latter being thoroughly protected against dirt.

The new drive bushing joint helps to carry out this important principle even in tightest places. Tubing as small as 3/32-in. diameter can be connected in this manner. For such a size, the diameter of the drive bushing collar is only 3/16 inch.

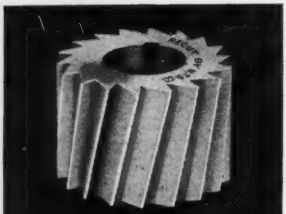


Bijur Driving Bushing Connection comprising, left to right, Complete Tubing Connection (Enlarged), Drive Bushing and Tubing, Reamer, and Drive Tool



BEFORE

AFTER



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The National Tool Salvage Company will grind them to their original accuracy, (retaining their temper) and guarantee them to be as good as new. Illustrations show a plain mill before and after recutting by the N. T. S. method at a saving of almost 60%.

Write for prices and our 18 page illustrated catalog.

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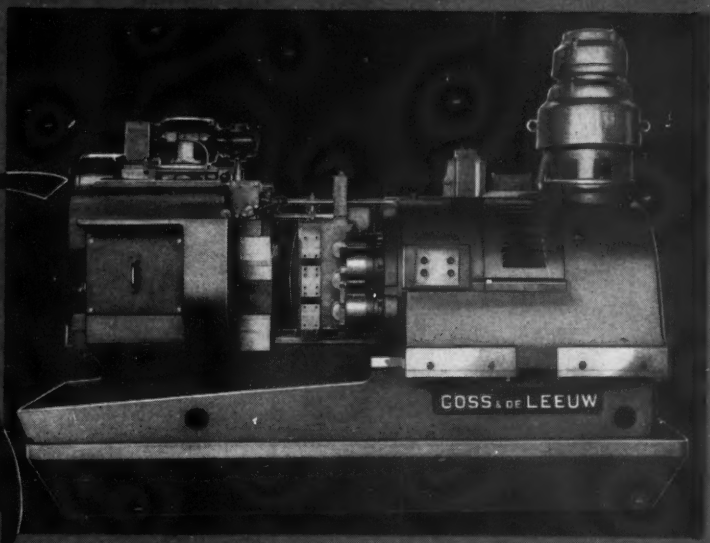
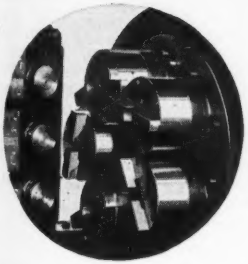


SKINNER of course!



Here's an unbeatable combination for speed and power . . . the new Goss & De Leeuw Multiple Spindle Chucking Machine—and its nest of five Skinner Chucks. These Skinner Chucks are built to take any load with a fast, sure grip, under any production pace. Weight and strength—efficiency and dependability are inherent in these Skinner Chucks. Holding power is more than ample for any set-up. As demonstrated by the choice for this machine, the safe Chuck specification is—Skinner, of course.

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PLANER CHUCKS
VISES—POWER CHUCKS

SKINNER CHUCKS

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NEW BRITAIN, CONN.

CERROMATRIX

does another job better

Because of the exceptionally low melting temperature of CERROMATRIX (250° F.) it can be cast against materials that would be damaged or destroyed by higher temperatures. This makes possible such applications as the one illustrated above, in which Cerromatrix, in order to provide a nest for a drill jig used on plastic parts (Bakelite, etc.) is cast against the part itself. An alloy of bismuth, lead, tin and antimony, Cerromatrix has peculiar properties that make it a useful metal for many uses. Expands slightly on cooling, tensile strength 13,000 lbs. per sq. in., Brinell 19. Among its useful applications are: matrix metal for locating die parts; models for engraving machines; anchoring parts in machine tools, etc.

Send for free Cerromatrix booklet.

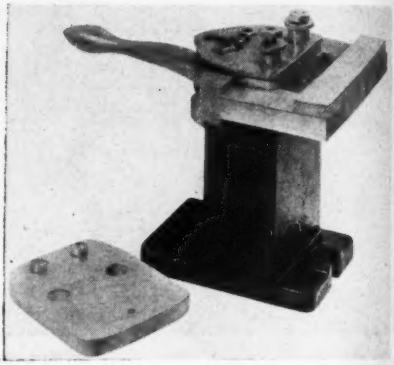
CERRO DE PASCO COPPER CORPORATION

44 WALL STREET, NEW YORK, N. Y.
British Associates: Mining & Chemical Products, Ltd., London, Eng.

Knu-Vise Drill Jig

The illustration shows a knuckle action vise drill jig designed for adaptation to a variety of work and placed on the market by Knu-Vise Products Company, 6430 Cass Ave., Detroit, Mich. The jig is intended for use on drilling, reaming, tapping, milling, and other operations where speed in the insertion and withdrawal of parts from the jig is essential.

The work is grasped by a jaw insert which is supplied as a blank and finished to fit the contour of the work; thus the jig can be used on as many different jobs as there are inserts. Tremendous pressure is exerted by the clamping action which is controlled by the handle, movement of the handle through a 30-deg. arc being sufficient to open the jaws ¾ in.—which is enough for most jobs. The work is held rigidly and is easily and almost instantaneously loaded or unloaded. The vise jaws are case hardened and ground. The bushing plate and angle support bracket can be made by the customer or can be supplied upon special order.



Model No. 325 Knuckle Action Knu-Vise

Kingsbury Solenoid

Finding existing solenoids inefficient for the operation of the machine tools built by the Kingsbury Machine Tool Corporation, Keene, N. H., this firm perfected an A.C. solenoid for their own use. Since its development, the insistent call for Kingsbury solenoids for use in other machines has lead the Kingsbury Machine Tool Corporation to establish a department for the manufacture of these solenoids in quantity and to handle all

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Small Tools

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Valuable Blue Prints

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Shop Records

SAFE in "HALLOWELL"

Fig. 1040—"HALLOWELL" Steel Bench Drawer. With pilfer proof Cover, for All Wood and Steel-Wood Top Work Benches and Tables.

STEEL BENCH DRAWERS

These strong, steel Bench Drawers can be easily attached to ANY bench. Handy for safe keeping of small precision tools, valuable blue prints and records—"Hallowells" have master-keyed locks (or padlock, if you prefer). They withstand rough usage, last much longer than clumsy wooden drawers, and never shrink, swell, stick or jam because of the weather.

Our Bulletin gives you details and prices.

Corners reinforced by heavy folded top, lapping around under front and welded.

Positively locked handles — their ends pass through front and are clinched

STEEL TOTE PANS FOR EASY HANDLING AND STORAGE OF SMALL PARTS OR TOOLS

These welded steel tote pans are very sturdy, intended for heavy work and made to take lots of rough handling. They cannot break-up or become oil soaked like wooden boxes. The handles are cleverly clinched in place and cannot come loose. They're designed so that they can be stacked high without wobbling or toppling. Of course, they're fire-proof. Write for full information.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA.

BOX 556

BRANCHES
BOSTON
DETROIT
INDIANAPOLIS

BRANCHES
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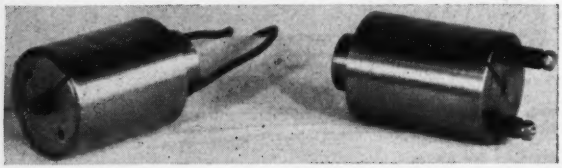
SAN FRANCISCO

engineering work necessary for their proper application and mounting.

The Kingsbury Solenoid is cylindrical in shape, facilitating mounting and making a high degree of mechanical perfection economically feasible. As a result of the cylindrical shape, the solenoid is small and compact and is balanced magnetically.



Kingsbury Solenoid. (Left) Model 32-269 (Right) Model 150-1

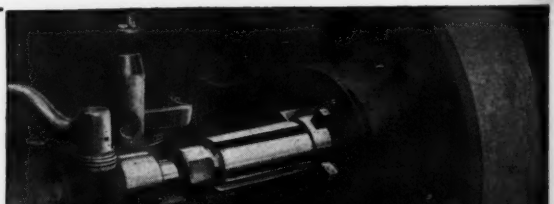
The coil is wound directly on a phosphor bronze coil bushing between bobbin heads molded of a special high strength material. In winding a cotton interweave is used which is carefully and completely impregnated to gain maximum electrical and minimum thermal insulation. The coil is rigidly mounted in a steel case which protects it from mechanical injury and forms a magnetic shield. The coil is wound in even layers and impregnated thoroughly with an oil and moisture resisting compound. Because of the nice magnetic balance and high grade bearing between plunger and coil bushing, operation is possible in any position with equal efficiency. The construction admits the use of a magnetically shielded return spring which still further facilitates mounting in any position.

At the right of the illustration is shown the Model 150-1 Solenoid, the design of which is distinguished by terminal towers molded integral with the coil bobbin flanges. The coil is wound between molded flanges, directly on the bronze bushing which forms the plunge bearing. The case is made from a low carbon steel bar slotted to minimize circulation of eddy currents. The case cap is screwed into the case, locking the coil rigidly in place. The coil is located by means of cylindrical rabbet fits on the ends of the bushing. The pole piece and plunger are of low carbon steel, multiple slotted to reduce eddy currents and

With

NICHOLSON EXPANDING MANDRELS

you have available for immediate use internal chucks for holding any hurry-up break-down job that comes along. Can be used on lathes, grinders, shapers or millers. Take any bore—½" to 7". Made in fourteen sizes. Bulletin 530.



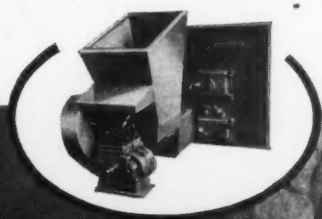
3 and 4-Way CONTROL VALVES for operating single or double acting air, steam, water or oil cylinders. Made in lever, foot, solenoid and motor operated. All pressures up to 3000 lbs. Bulletins on request.

Other Products: Arbor Presses, Flexible Couplings, Steel and Stainless Ball Floats, Steam Traps and Separators, Air Separators, Traps and Vents, etc.

W. H. NICHOLSON & CO. 136 OREGON STREET, WILKES-BARRE, PENNA.

Here's how BROWNELL makes "heavy" assemblies TWICE AS FAST...AT HALF THE COST

Joining heavy gauge steel air duct pipe and steel fan housing with Hex Head Self-tapping Cap Screws.



Fastening cast iron inlet ring to fan housing. Also see name plate attached more securely and cheaply with Type "U" Screws.

Have a Parker-Kalon Assembly Engineer show where YOU can make better fastenings at lower cost by changing to Parker-Kalon Self-tapping Screws

These Brownell Stoker assemblies will interest any design or production man who is concerned with joining or making fastenings to heavy gauge steel. For these examples prove that it is possible to reduce costs, and at the same time, obtain great security.

The Brownell Co. actually cut costs in half, and doubled assembly speed on the jobs shown. And, they did it by the simple substitution of Parker-Kalon Hex Head Self-tapping Cap Screws for ordinary cap screws that required slow and costly tapping. In addition, it was found that the simpler, cheaper Self-tapping Screw method produced stronger fastenings.

For assembling steel plate and structural shapes up to ½ in. thick the Hex Cap type of Self-tapping Screw proves ideal. It is also widely used for making fastenings to light gauges of sheet metal as well as die cast metal or plastic parts.

Whether your work involves heavy or light assemblies of metal or plastics . . . fastenings that can be removed and replaced repeatedly, or permanent fastenings . . . the chances are that one of the various types of Parker-Kalon Self-tapping Screws would do the work better, for less money. To learn just what could be accomplished on your assembly jobs is simple and does not obligate you. Just write us to have a Parker-Kalon Assembly Engineer check over your fastening requirements and point out possibilities.

PARKER-KALON CORPORATION
Dept. M, 198 Varick Street New York, N. Y.

PARKER-KALON *Modern* FASTENING DEVICES

A HARDENED SELF-TAPPING SCREW FOR EVERY KIND OF ASSEMBLY

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

chromium plated to reduce wear and minimize the effect of residual magnetism.

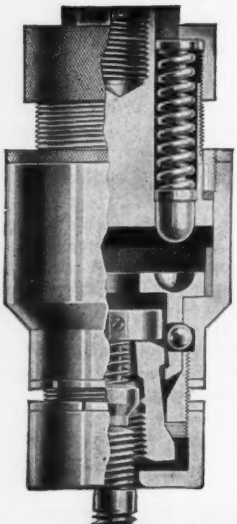
At the left is shown the Model 32-269, the distinguishing features of which are lead wires in place of terminals and —rating considered—the ultimate in compactness. The same general construction is used as in the Model 150-1, but special oil and water resisting lead wires are brought out through molded insulating bushings made integral with the bobbin flanges. This design, as in the 150-1, admits the use of a helical return spring shielded magnetically and supported by the spring guide. The spring has been carefully designed for a low fibre stress and to eliminate failure due to harmonics.

Economist Assembly Rack No. 48

To aid in assembling small parts at the bench, the assembly rack shown in the illustration has been developed by Gordon L. Hall, Old Lyme, Conn. The maximum height of the rack is 8 in. and the front to back depth is approximately 12 in. Four standard lengths are available: 8, 12, 16 and 20 in. These four lengths make possible a wide range of flexibility in arrangement. The two sizes of containers or bins will fit all rack lengths and any 8-in. bin is interchangeable in any rack position with two 4-in. bins.

Model 48 Economist Racks Arranged for Use

Single work places can be arranged for a maximum of convenience with bins varying in number from three 8-in. bins in a single 8-in. rack to 36 4-in. bins in three semi-circular 16-in. racks. Each bin is easily removed from the rack for refilling or emptying. The racks are finished in olive green.



TITAN STUD SETTER

CONTROLLED DRIVE Assures Perfect Setting

The Titan Stud Setter has a safety clutch which controls driving power.

The Titan is positive in driving and automatic in releasing, thus making it possible to set the studs to any predetermined degree of tightness.

When the studs are driven to the specified tightness, the drive is automatically released and the tool may be removed without fear of mutilating or distorting the threads.

The great capacity, speed range, utility, and safety of this production tool make the Titan Stud Setter a profit-earning tool wherever it is used.

Write today for the new illustrated circular.

TITAN TOOL COMPANY

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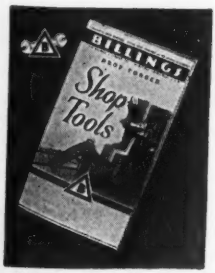
VITALLOY

TRADE MARK

WRENCHES

Billings latest contribution to wrench users—Billings Vitalloy Wrenches! The results of three-quarters of a century of forging experience, engineering knowledge combined with present day achievements of metallurgical knowledge and engineering skill—Controlled Grain Size Special Alloy Steel—to Billings specifications.

The recessed panel ("I" beam type of design) allows for a firmer and more comfortable hand grip. Vitalloy Wrenches have a lasting triple-plated chromium finish. The same Guaranteed Quality you look for in all Billings Duo-Forged Tools are in these new Billings Vitalloy Wrenches—You'll like them!



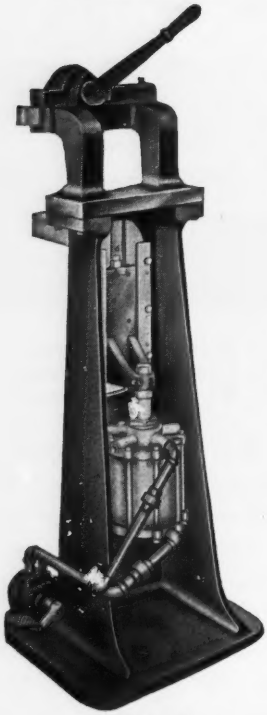
"Shop Tools" Book
Write Dept. "O".

Ask for BILLINGS VITALLOY *Wrenches*

LONGER LIFE in FORGED TOOLS

MARKING

FLAT—ROUND IRREGULAR SURFACES BY ROLLING OPERATION



MODEL 25

HI-DUTY MARKING MACHINE

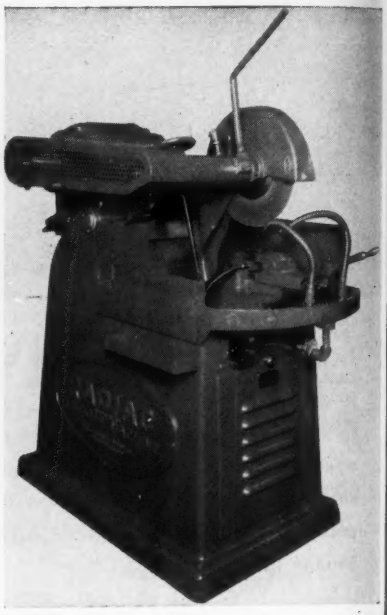
This machine operates from your plant air line, and is one of numerous models built to produce fast, neat marking on metal parts. Hi-Duty marking machines may be had for practically any marking operation, and we will be glad to make recommendations upon receipt of your inquiries. Send prints or samples of parts to be marked, showing lettering and location, also state required production.

GEO. T. SCHMIDT, Inc.

1806 BELLE PLAINE AVE.
CHICAGO, ILL.

Radiac Type K Cut-Off Machine

A. P. de Sanno & Son, Inc., 1615 McKean St., Philadelphia, Pa., has added to its line the Type K Radiac Cut-Off Machine shown in the illustration. The Type K machine is an improvement on the Type J which is also made by this firm, and is arranged for both wet and dry cutting. The abrasive wheel spindle can be operated at either high or low speed, this flexibility being accomplished

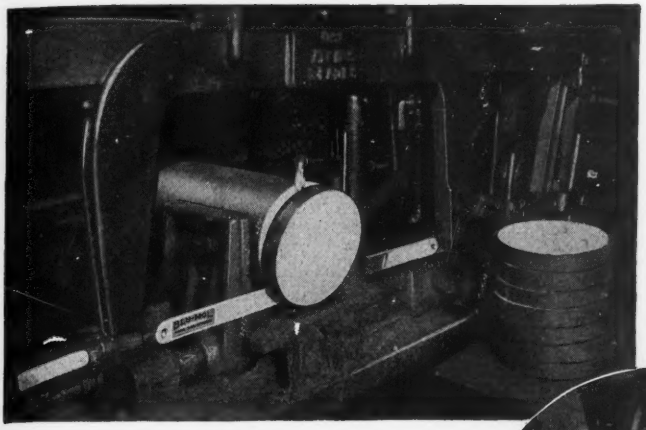


Radiac Type K Cut-Off Machine

by the use of a two-speed motor. The high and low speeds are selected through the operation of a crank handle on an electric controller box.

The cutting is accomplished by rubber bonded disks which are flushed with coolant at both high and low speeds. Resinoid bonded disks are used for high speed cutting and are operated both dry and wet. When using the wheels dry, a metal tray is inserted in the vise table to catch the dust.

The general appearance of the Type K machine is the same as the Type J and the general mechanical characteristics and capacity are identical.



ARE YOU GETTING *Performance* LIKE THIS?

This is an actual photograph of a BLU-MOL Molybdenum hack saw blade on the job, and here's its actual performance record at the time the photograph was made:

MATERIAL—3¾ inch bar of Crescent Tool Steel, analyzing 100-110 carbon.

SPEED—75 strokes a minute.

PRESSURE—125 pounds.

PERFORMANCE—152 cuts—1678 square inches.

The teeth were still keen, the set in excellent condition and the blade was still cutting true and fast. The operator estimated it was good for at least 70 more cuts, or a total of 2448 square inches—a blade cost of only 1/3 mill per square inch.

Here's proof that BLU-MOL Molybdenum Blades give the lowest cost per cut of any hack saw blade on the market. If you're not using BLU-MOL Blades it will pay you to investigate. For a test on your own work 'phone BLU-MOL distributor or write to us.

MILLERS FALLS COMPANY

Greenfield, Massachusetts

MILLERS FALLS TOOLS
SINCE 1868

Tamms Pyramid Pyrometer

A pyrometer especially designed for the accurate calibration of molten metals has been brought out by Tamms Silica

Tamms Pyramid Pyrometer

Company, 228 N. LaSalle St., Chicago, Ill. The pyrometer works on the thermo-electric principle. Convenience of adjustment is the outstanding feature, perfect calibration being maintained constantly through a thumb screw adjustment on the face of the dial. Another feature is the flexible end, which is adjustable to 180 deg. with perfect calibration assured. This feature minimizes the possibility of dirt deposits which hamper accurate readings. All electrical parts and connections have been enclosed for positive protection and all parts are interchangeable for economy of maintenance.

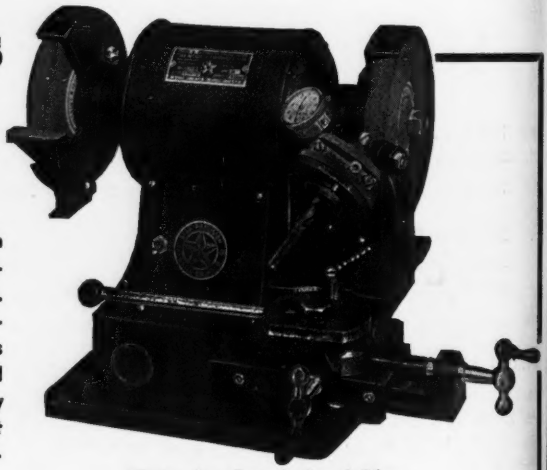
The pistol grip handle provides for ease of handling and both the handle and indicating dial are arranged at such an angle that quick, accurate readings are possible without eyestrain or cramped posture. As a further convenience, the base of the handle provides a good-sized hole suitable for hanging the instrument in a safe place when not in use. The Pyramid Pyrometer is light in weight and easy to operate.

Gray No. 4A Turret Head Metal Cutter

The line of metal cutters and nibbling machines made by the Gray Machine Company, Philadelphia, Pa., has been augmented by the addition of the No. 4A Turret Head Metal Cutter illustrated herewith. This machine has a 24-in.

Grinds
81 SIZES OF
Drills
No. 31 to ½"

This Star Precision Grinder puts drill grinding on a production basis. Its simplicity and accuracy saves as high as 50% on drill costs and insures uniform accuracy that guarantees perfect holes and increases production.



Write for descriptive folder.

STAR MACHINE & ENGINEERING CORP.
Division of Star Electric Motor Co.
BLOOMFIELD AVE. BLOOMFIELD, NEW JERSEY

SURE, SCRAP TOOLS LOOK ALIKE . . .

. . . BUT, SOME *ARE DIFFERENT* . . .

You can't make a reworked tool that will "stand-up" from a worn tool that has lost its hardness. That's why we give each tool, received for RENU*ing*, a Rockwell Test—and return it to the sender, without charge, if it fails to measure up to 63°-64° hardness.

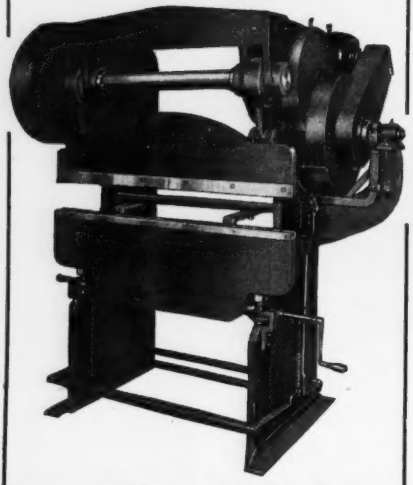
This practice is typical of the kind of service you can always expect from RENU—a service that enables you to save from 30% to 75% on tool costs because RENU*ed* Tools are GUARANTEED the equal of new tools, both for appearance and performance.

- A new sixteen-page book that tells the whole story mailed on request, no obligation.

Renu TOOL COMPANY • 275 E. MILWAUKEE AVE. • DETROIT

CHICAGO STEEL PRESS

No. 253



Does 40% to 60% of the forming work turned out by the average shop.

Here's a profitable, economical brake ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes, and a great variety of sheet metal specialties. Its variable speed drive operates from 17 to 50 strokes per minute. The No. 253 CHICAGO STEEL PRESS is accurate, compact, and ruggedly constructed of highest quality materials.

Sizes 4, 5 and 6 ft. capacities, up to 10 gauge.

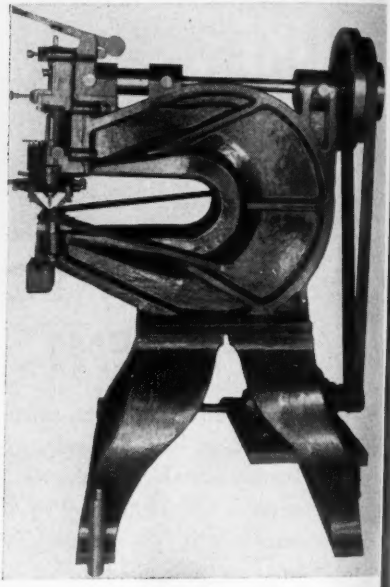
Write for Circular No. 253

DREIS & KRUMP MFG. COMPANY

7418 LOOMIS BLVD.

CHICAGO ILLINOIS

throat and capacity of ⅜ in. As shown, the machine is equipped with table support arms for supporting stock in any position, and leaning against the front leg of the machine is shown an interchangeable eccentric. The eccentric is said to be very important for a machine of this type as it broadens the possibilities for handling large work. The



Gray No. 4A Turret Head Metal Cutter

eccentric can be changed to accommodate shearing attachments for shearing stock up to and including ⅛ in. in thickness as it is often desirable to shear stock instead of nibble.

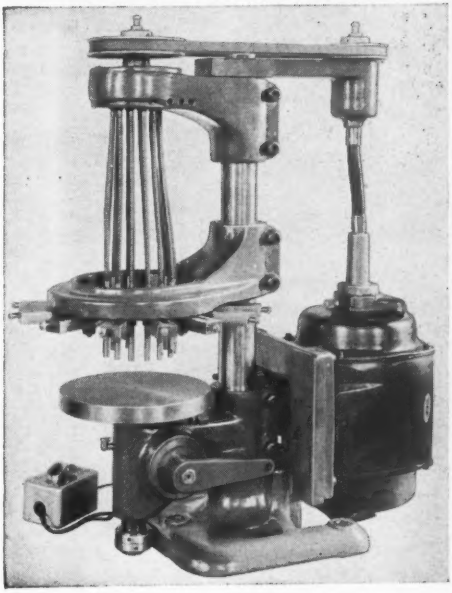
In other respects the machine is practically identical with the other sizes of Gray Turret Head Metal cutters made by this firm.

National Centrifugal Oil Extractor

The Leon J. Barrett Company, Worcester, Mass., has added to its line the "National" Extractor shown in the illustration. This extractor operates upon the centrifugal principle, oil being impelled by centrifugal force from the saturated chips which are held securely in the container. Only the finest particles

Adjustable Spindle Drill Press made with S. S. WHITE FLEXIBLE SHAFTS

• In this compact drill press, made by the Automatic Machine Company of Bridgeport, Conn., the use of S. S. WHITE Power Drive Flexible Shafts, provides an effective adjustable spindle arrangement that makes possible the setting of drills for any number of different hole combinations.



• a large diameter S. S. WHITE shaft also serves to transmit power from the motor to the countershaft.

• In addition to the advantage of flexibility, S. S. WHITE Flexible Shafts are fully capable of standing up in hard, continuous service, typified by a drill press, because they are not just coils of wire, but real shafts, soundly engineered and built to perform the duty for which they are intended.

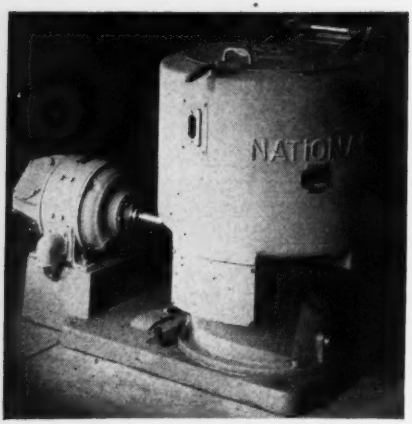
•

ENGINEERING COOPERATION

We will be glad to help you work out any specific power drive or remote control problem . . . no obligation . . . just send us the details.

•

The **S. S. WHITE** Dental Mfg. Co.
INDUSTRIAL DIVISION
10 EAST 40th ST., ROOM 2310S, NEW YORK, N. Y.



National Centrifugal Oil Extractor

may strain through between the pan top and the closely fitting cover. Further treatment of the oil is seldom considered necessary, but should precipitation of sediment or sterilization be required, the firm mentioned also is prepared to furnish sterilizers, filters, pumps and tanks.

The machine is said to recover 98½ per cent of all removable oil from chips in a three-minute run, leaving the chips dry. The work pan is of one-piece pressed steel, and is practically indestructible. The base, column, curb and drum are cast of semi-steel, of heavy cross section. The alloy steel spindle is vertically mounted in ball bearings in a heavily cast gear box with a ball base that oscillates slightly in a base socket. Radial balancing springs compensate for gyration, yielding at critical speeds due to uneven load. Spiral gears, accurately ground to eliminate noise and totally enclosed in an oil bath, are driven by a self-adjusting right angle shaft, universal in action to motor or pulley. No belts pass under the machine. Forced lubrication is used. All parts are standardized for interchangeability. Plain or safety lids are furnished in accordance with all state requirements, and all safety features are available. Hoists of any type are supplied.

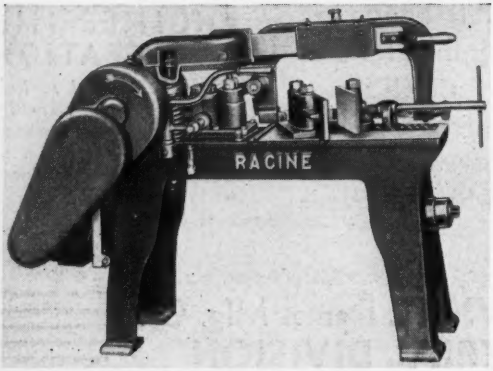
The extractor is made in seven different sizes with pans ranging from 15 to 30 in. in diameter and from 4¾ to 14 in. in depth. The height of the machine above the floor ranges from 35 to 45 in. and the amount of floor space ranges from 30x50 to 44x78 in. Shipping weight, approximately, 1185 to 3400 pounds.

RACINE

ANNOUNCES

The NEW RACINE Utility Saw

6"x6" Capacity



Simplified Hydraulic Feed—Modern Design. Engineered and built by pioneers in the field. RACINE Dealers everywhere will gladly tell you about this remarkable, new, low priced machine.

Write for catalogue.

"Standard the World Over"

RACINE TOOL & MACHINE CO.

1770 State St. Racine, Wisconsin.

Gammons

REAMERS AND END MILLS

ORIGINATORS of the
Helical Taper Pin Reamer
Special Reaming Problems Invited
Immediate Shipment on Stock
Tools

SEND FOR CATALOG
Dept G

SPIRAL SPECIALISTS

THE GAMMONS-HOLMAN CO. MANCHESTER, CONN.

"Curtain of Light"

The simplicity and effectiveness of the photoelectric cell have given it a versatility practically unequaled by any other mechanism for the operation of mechanisms of all kinds. The latest application of the phototube is in the interest of safety, comprising a control which prevents the operation of a stamping press when the beam of light from the cell is intercepted by any part of the operator's anatomy. In presses that open from 12 to 1 in., however, a single beam of light cannot be depended upon to offer the desired protection because the operator might avoid intercepting a single beam when inserting or removing stock. To insure the effectiveness of the application, a series of phototube cells are employed resulting in a continuous curtain of light which is as high, if not higher, than the maximum opening of the press. This application, known as the "Curtain of Light," is a development of the Electronic Control Corp., 2830 E. Grand Blvd., Detroit, Michigan.

"Curtain of Light" Installation on a Sheridan Embossing Press

As can be seen from the illustration, the equipment consists of a specially designed light-source comprising a series of phototubes, a system of mirrors, the phototube housing, and the phototube amplifier. The light source is housed in a rugged container with the lenses and lamps built as a unit so that uniform alignment of the curtain of light is maintained even though the exterior housing might be slightly damaged by carelessness. The light source uses standard 50 or 32 candlepower 6-8 volt automobile headlight bulbs, operating from a self-contained transformer supplying slightly less than 5 volts to each lamp. The phototube housing is unique in design, the condensing lenses being arranged so that every section of the curtain of light actually impinges on the cathode of one of the phototubes. This design eliminates dead spots which could be intercepted and yet not actually cut off light from the cathodes of the phototubes. Although the curtain of light is 13 in. in height and approximately 2 in. in thickness, the amount of light cut off by an ordinary lead pencil inserted at 90 deg. to the axis of the beam of light causes sufficient fall off in light intensity to drop out the relay and stop the press within 3/8 in. of die movement. To insure fool-proof operation of the

"OUTWEARS the best Bronze Metal"
20 years ARGUTO without a drink—
ARGUTO OILLESS BEARING CO.
Wayne Junction, Philadelphia, Pa.

THE FASTEST

operating of all grinding wheels... The STERLING RESINOID snagging wheel has earned its way to the top because of its ability to produce... Give the STERLING wheel a chance to show itself and you will be convinced it is a truly remarkable producer...

THE STERLING GRINDING WHEEL CO.

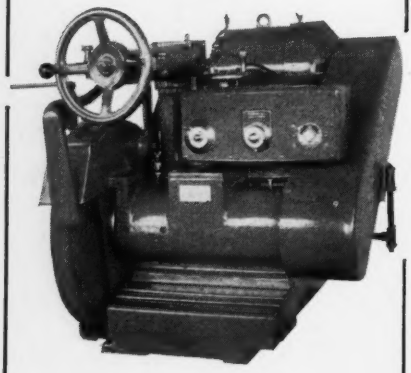
Abrasive Division of The Cleveland Quarries Co.

Factory and Office: TIFFIN, OHIO • CHICAGO: 912 W. Washington Blvd. • DETROIT: 101-107 W. Warren Ave.

STERLING ABRASIVES

The BOWGAGE

INDEPENDENT GRINDING WHEEL HEAD



A self-contained unit hydraulically operated with an automatic grinding cycle —with DIMINISHING FEED. Can be applied to most any plain grinder.

Weight 1900 lbs. Takes wheels 24"x2"x12" — 20"x 4"x12".

•

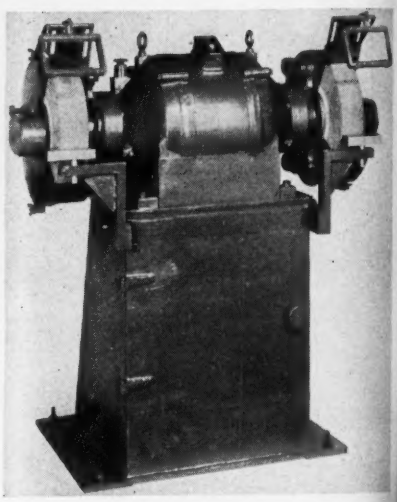
FITCHBURG GRINDING MACHINE CORP.

Fitchburg, Mass.

safety device, the control equipment was designed so that in the event of power failure, tube fatigue, or a burned-out light source lamp, a weighted arm disengages the clutch and applies the brake so that the press will stop within 3/8 in. movement of the dies. The "Curtain of Light" when installed on a press of the type shown in the illustration not only insures safety to the operator but also increases production due to the fact that the press is completely controlled by the curtain of light. As the operator steps back and withdraws his arms from the curtain of light area, the press automatically starts and proceeds through its cycle.

"Production" Type 268 14x3-In. Grinder

The Production Equipment Company, 5219 Chester Ave., Cleveland, Ohio, announces several recent changes in the



"Production" Type 268 5 H.P. 14x3-In. Grinder

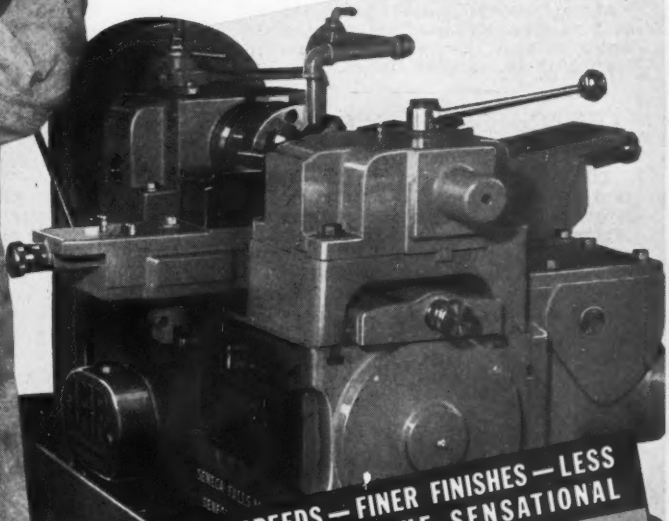
design of their Type 268 Grinder. This machine, which is built for heavy duty applications in ratings from 3 to 15 h.p., has been redesigned to provide a number of new features.

The wheel guards, which are of welded steel construction conforming to the Safety Code requirements, have been made adjustable to wheel wear and can be rotated as to position of grinding. Adjustable safety glass eye shields have

Here's the **LATHE** *they're all talking about!*

Whenever production men gather, in any one of a dozen different industries, you'll hear the new *So-swing* IMP discussed. You'll hear how this compact, little, fully-automatic lathe has knocked former production costs silly. You'll hear about its speed and almost unbelievable accuracy. You'll hear about its flexibility and adaptability. You'll hear how varied operations have been combined on a single *So-swing* IMP.

You'll hear enough to make you anxious to get *all* th facts. And to make that easy, we have printed th new bulletin and provided a coupon at the bottom this page.



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MAIL THIS COUPON

HIGHER SPEEDS—FINER FINISHES—LESS OVERHEAD WITH THE SENSATIONAL

IMP

So-swing

SENECA FALLS MACHINE CO., 310 Fall St., Seneca Falls, N. Y.

Please send your new IMP Bulletin.

Name _____

Company _____

Address _____

City and State _____

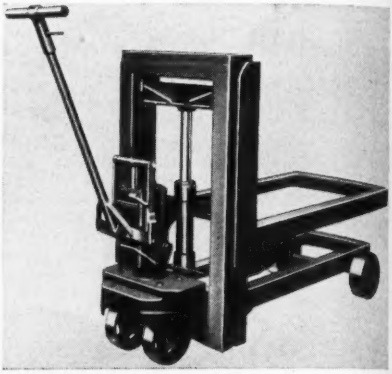
been mounted on the guards.

The tool rests are now located on the base and are adjustable by slide and clamp attached to the sides of the base. This construction provides rigidity with all strains absorbed directly by the heavy base. A hinged door of unusual width is located on the front of the base to give ample room for inspection or repair of the magnetic starter, which is located inside the base. The push button is mounted on top of the motor where it is convenient for the operator. A heavy shaft locking device has been added which securely clamps the spindle while wheels are being changed.

Any or all of these features can now be furnished on the Type 268 Grinder, which is built for wheel sizes ranging from 12x2 in. to 24x3 inches.

Lyon Cantilever-Type Hydraulic Lift Truck with 10-In. Elevation

The lift truck shown in the illustration, an adaptation of the standard Lyon Hydraulic Lift Truck made by Lyon Iron Works, Greene, N. Y., was designed for a special handling problem where 10-in. elevation was necessary instead of the usual standard 3-in. elevation. The



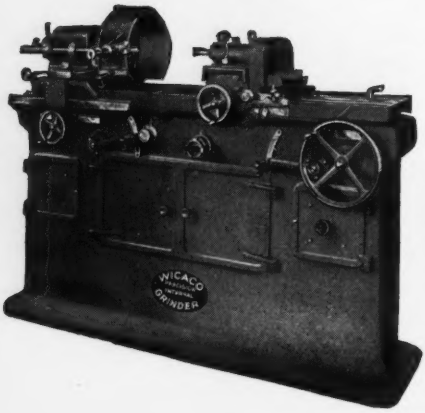
Lyon Cantilever-Type Hydraulic Lift Truck with 10-In. Elevation

10-in. elevation is obtained with the cantilever-type elevating frame.

The hydraulic elevating feature provides exceptionally easy lift, easy control and easy handling. The truck shown is rated at 3500 lbs. capacity. The lowered height is 9 in. and the elevated height is 19 in. The carrying

WICACO

Puts You Way Behind the Decimal Point



5 Precision Features

Positive Stop for Blind Hole Grinding

Underslung Drive

Water-Cooled Wheel-Head

Instantaneous Reverse

Rigid Work-Head

The New WICACO Precision Tool Room Grinder puts you WAY behind the decimal point when it comes to close tolerances.

The WICACO is the last word in accuracy. It will pay you to investigate this machine. Write for complete facts.

THE WICACO MACHINE CORP.

WAYNE JUNCTION PHILADELPHIA, PA.

Est. 1868

SMALL DISPLACEMENT

Thin fish cut along with but little displacement of water.

Napier Blades, too, cut with but little displacement. The kerf of the heaviest is .049"—as against .25", or more, of a circular saw. The saving is amazing.

In cutting a steel bar 20"x6" into ½" discs, for example, the Napier Band Saw gets 9 more discs than does a circular saw. Metal wasted is money lost. Save metal and money with a Napier.

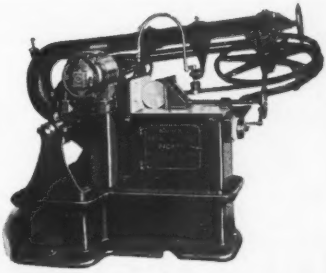
Write for illustrated broadside giving complete data on the ten money-saving features of the HORIZONTAL NAPIER BAND SAW MACHINE.

METAL SAW & MACHINE CO.

40 NAPIER STREET SPRINGFIELD, MASS.

TEN OUTSTANDING FEATURES

1. Accuracy
2. Speed
3. Small Displacement
4. Prolonged Cutting Power
5. One Horsepower
6. Handles both Large and Small Work
7. No Time Out
8. Low Installation Cost
9. Low Depreciation Cost.
10. Skilled Handling Unnecessary



platform is 24 in. wide by 42 in. long. The illustration shows the truck elevated to the full height of 19 inches.

Williams "Vulcan Supertong"

A chain pipe tong drop-forged from alloy and high-tensile steel and heat treated, which is to be known as the "Vulcan Supertong," has been placed

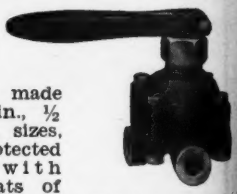
Williams "Vulcan Supertong"

on the market by J. H. Williams & Co., 75 Spring St., New York, N. Y. The design and structural features of "Vulcan Supertongs" are identical with those of Williams "Vulcan" Tongs; however, the manufacturer states that "Vulcan Supertongs" have at least 50 per cent greater strength than regular Vulcan Tongs of corresponding size, without any increase in size or weight.

"Vulcan Supertongs" are equipped with Williams new "Superchains", which are made from alloy steel, heat treated and cadmium plated. "Vulcan Supertongs" are made in eight sizes for pipe from ⅛ to 18 in. The tongs are finished in gray enamel and the jaws have a blue panel with bright faced edges.

Nicholson Style J Control Valve

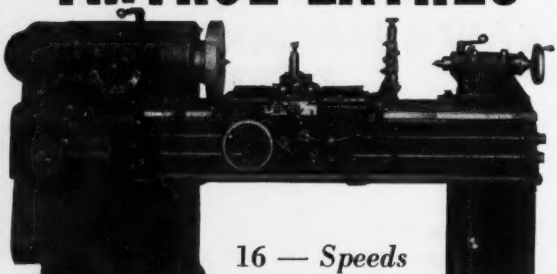
Recent addition to the company's several lines of control valves for all pressures and mediums is the model illustrated, designated Style J, a low-priced, non-leaking valve in three and four way types, for operating single and double-acting cylinders utilizing air or oil on pressures to 125 lbs., a product of W. H. Nicholson & Co., 229 Oregon Street, Wilkes Barre, Pa.



Nicholson Style J Control Valve

The valve is made in ¼ in., ⅜ in., ½ in. and ¾ in. sizes, of flat disc, protected seat design, with bodies and seats of semi-steel, discs of bronze. Port areas are equivalent to full area of pipe sizes they accommodate, and port design permits throttling or full

SIDNEY
TRITROL LATHES



16 — *Speeds*

• FEATURES:

Timken Roller Bearings.
Multiple - Disc Driving Clutch.
Choice of three types of drives.
Adjustable Automatic Feed Release.
Sykes Continuous Tooth Herringbone Gears.
Lathe Bed has hardness of at least 190 Brinell.

Write for complete details.

"Lathes and Milling Machines"

THE SIDNEY MACHINE TOOL CO.
210 HIGHLAND AVENUE • SIDNEY, OHIO

4 Big Reasons for Using DELTA DRILL PRESSES

A battery of twelve 17-inch Delta drills saving money for a Detroit auto-accessory manufacturer.

1. They are low in first cost.
2. They are extremely economical to maintain and operate.
3. They are highly adaptable, and engineered for long life.
4. They will continue to save you money throughout their entire life.

Because Delta drills are built to precision standards in a modern production plant, they cost you less than any comparable drills you can buy.

Because they are equipped with self-sealed ball bearings throughout, they require no lubrication at any time—and practically no other maintenance.

Because they are thoroughly engineered and tested under production, they will "stand up and take it" alongside drills costing several times more.

Because of their low cost, low maintenance and low power consumption, they can be used in dozens of places in your plant where heavy, expensive machines would be out of the question.

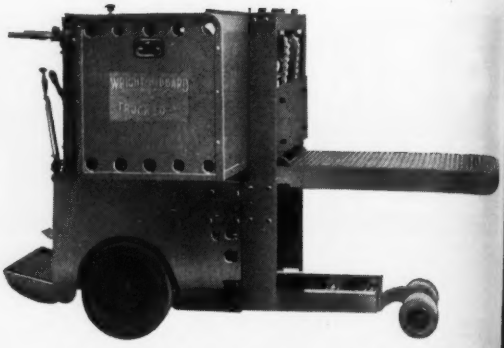
Let us tell you the complete story of Delta Drill Presses, 11", 14" and 17" models. Write—NOW—for complete information and name of nearest dealer. It will pay you dividends.

DELTA MFG. CO.

609 E. VIENNA AVE.
MILWAUKEE, WIS.

opening, as required. All pipes are 90 degrees apart and lead from valve base horizontally. Valves can be dis-assembled for inspection without breaking pipe connections. Operating levers require 90 degrees travel for complete cycle and may be easily adjusted radially on valve stem to suit convenience of operator.

Wright Hibbard Industrial Truck



Wright Hibbard Industrial Electric Truck

A new electric high lift platform truck has just been recently developed by the Wright Hibbard Industrial Electric Truck Company, Phelps, N. Y. The truck has been designed with the ultimate feature of compactness in overall dimensions. The overall length of the truck with a 42-in. long loading platform is 89 in. and the overall width is 28½ in. with the average size of battery required.

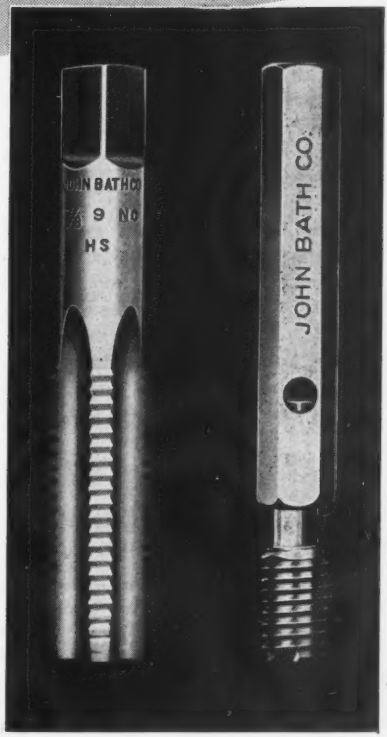
Another desirable feature is the type of lift used, which involves the use of a pair of steel roller chains, insuring maximum efficiency in power consumption and long life of the lifting mechanism. This truck, with loading platform of 18 in. to 28 in. wide and from 36 in. to 53 in. in length and from 6½ in. high to 11 in. in low position, has a maximum lift of 72 in. from the floor.

Full details are described in Folder No. 5, which may be had by addressing the company at the above address.

THE DECKEL
PRECISION UNIVERSAL TOOL ROOM MILLER FP1
Detachable swiveling work table shown is only one of its many new and exclusive mechanical features ask for FP1 booklet.
H. P. PREIS ENGRAVING MACHINE CO. • 153 Summit St. Newark, N. J.

like SCOTCH & SODA they go together—

BATH TAPS & THREAD GAGES



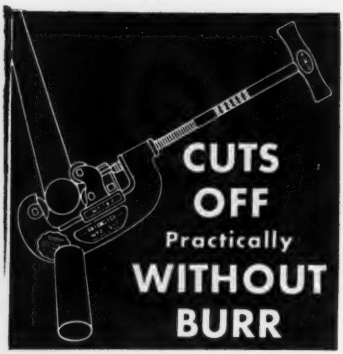
You get maximum accuracy from BATH Taps—from BATH Thread Gages too. Why not guarantee accurate results by using them together? In this way you check accurate tapping with an accurate gage—you *can't* miss.

BATH Taps and Thread Gages are ground from the solid *after* hardening. Thus, the teeth edges have the same perfect grain structure as the heart of the tool. They're tough all the way through.

BUY BOTH FROM BATH

JOHN BATH & CO.

WORCESTER MASS.



And This RIDGID Thin Tool-Steel Blade Wheel Is the Reason

If you want a new experience that will show you how quickly, easily and cleanly pipe can be cut, try a RIDGID Cutter.

You'll find the patented RIDGID Cutter wheel a real improvement. Coined out of tool steel sheet, hammered, heat-treated and cast into a steel-bearing hub, it rolls smartly through any pipe, practically without burr —many more cuts per wheel.

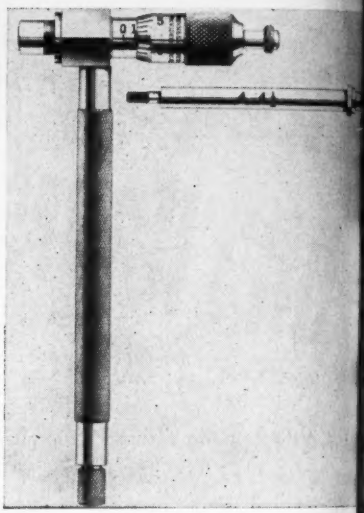
Try one at your Jobber's

THE RIDGE TOOL CO.
ELYRIA, OHIO

RIDGID
PIPE TOOLS

Brown & Sharpe Telescoping Ins Micrometer No. 268

A telescoping inside micrometer w which the diameter of a deep hole recess can be measured has been plac on the market by Brown & Sharpe M Co., Providence, R. I. To operate, it only necessary to insert the microme into the hole; the telescoping measuri point adjusts itself to the diamet The measuring rod is then located



Brown & Sharpe Telescoping Inside Micrometer No. 268

turning the knob at the end of handle, after which the tool can withdrawn. The micrometer thimble then revolved until it contacts shoulder of the measuring rod and measurement can be read in thousand directly from the micrometer. T thimble is graduated in thousandths an inch and a range of from 2 to 6 is available. Provision is made for justment of wear of the measur points.

Challenge Semi-Steel Layout Surface Plate

A new, improved Layout Surface Pl for accurate layout and inspection w is now being manufactured by The Ch lenge Machinery Co., Grand Haven, M

Now-
STILL GREATER
RANGE!
New, small size hones make it possible to hone quickly and accurately any size hole as small as .365" with a highly polished, base metal finish.
Particularly adapted for salvage, small run production, assembly, tool room and experimental work.

Solve your small hole honing problems with this new equipment

It requires less than one minute to set up and locate a part on the Sunnen Precision Honing Machine. A round hole is generated with a single cutting stone which is expanded to the full length of bore before any cutting action takes place. The two solid guide shoes of mandrel the same length of stone prevent any misalignment.

Expansion of stone and cutting pressure is controlled with a foot lever with a micrometer dial stop to adjust diameter size.

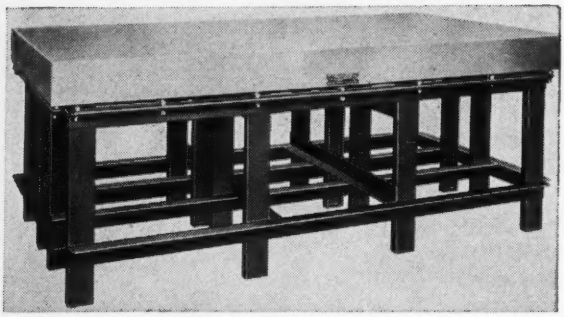
Various grades of stones can be furnished for any metal except babbitt and will hone in any diameter hole from .365" to 2.400". Accuracy within .0001" guaranteed for straightness and roundness.

SUNNEN PRODUCTS CO.
7903 Manchester St. Louis, Mo.

IF YOU HAVE A HONING PROBLEM send for a copy of our Honing Analysis Blank. Use it to give us full information and we will tell you whether or not this equipment is suitable and just what it will do for you.

SUNNEN PRECISION HONE

IT GRINDS • IT LAPS • IT POLISHES



Challenge Semi-Steel Layout Surface Plate

Challenge Semi-Steel Layout Surface Plates are especially designed for use in industrial plants that require a true, rigid, smooth surface for assembly, layout, and inspection of products in process.

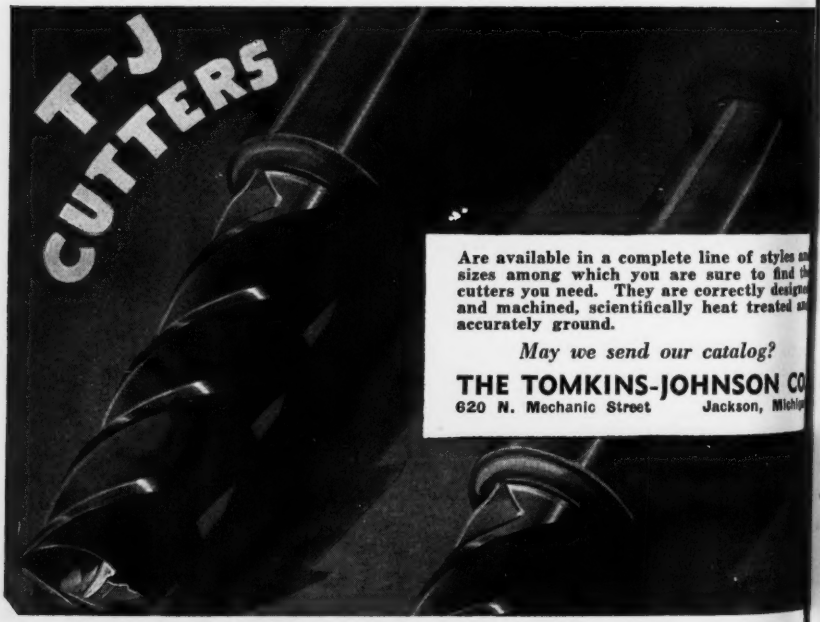
The semi-steel plate is planer finished, smooth, square, and heavily ribbed underneath to prevent sagging. It comes in standard sizes of 12x18 in. to 49x99 in. Special sizes can be made to order. The all-steel arc-welded frame is provided with 32 lock leveling screws.

Plates may be purchased with or without the steel supporting frame. Further information and prices are available on request to the manufacturer.

Jackson Model B4 Electrode Holder

Users of arc welding equipment have long sensed the need for an electrode holder that on light work would combine light weight with maximum conductivity, a holder that would be easy to handle and small enough to be successfully manipulated in tight places.

These qualities are claimed for a new type of holder just introduced by the Jackson Electrode Holder Company, 6558 Woodward Ave., Detroit, Michigan. The new model—B-4—weighs 15 oz., has a current capacity of 200 amps., handles rods 1/16-in. to 3/16-in. diameter and is made entirely of Mallory 3 Metal. This alloy insures strength and at the same time has 85 per cent of the conductivity of pure copper.


T-J
CUTTERS
Are available in a complete line of styles and sizes among which you are sure to find the cutters you need. They are correctly designed and machined, scientifically heat treated and accurately ground.
May we send our catalog?
THE TOMKINS-JOHNSON CO
620 N. Mechanic Street
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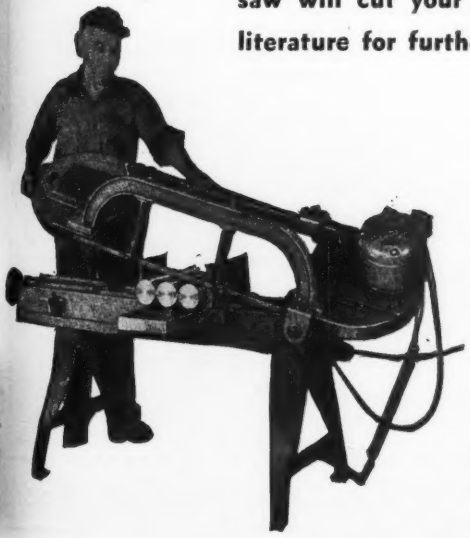
ACCURACY

For quantity production the WELLS METAL CUTTING BAND SAW can't be beat! Precision manufacturing methods, rigid ball bearing saw guides, a sturdy vise and perfect blade control guarantee accuracy. In maintenance and tool room work these versatile saws are invaluable. Bars, angles, tubes and sheets of almost any metal can be cut with unusual speed. A Wells saw will cut your production costs. Send for literature for further proof.



Built in two sizes:

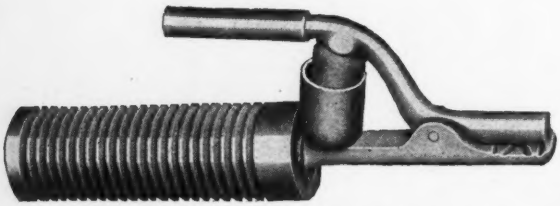
No. 5 SIZE 5" diameter round or 5"x10" flat.

No. 8 SIZE 8" diameter round or 8"x16" flat.

WELLS MFG. CORP.

THREE RIVERS, MICH.

The handle insulation is thoroughly ventilated. Upper tong and compression spring are amply protected by fiber insulation.



Jackson Model B-4 Electrode Holder

M & W Dielectric Enamel

A black enamel with special dielectric properties has been developed by Maas & Waldstein Company, Newark, N. J. This dielectric enamel is said to be especially suitable for finishing electrical apparatus, such as steel switchboards and instrument panels, coils, and radio bases. It dries to a rubber finish, and is tough, durable, and has high electrical resistance, according to the manufacturer. The enamel is applied by spraying, and a switch board panel that has been marred or defaced can easily be refinished without dismantling by spraying on another coat of the enamel.

A surfacer, with similar dielectric properties, is also supplied for preparing the surface to be finished with the enamel.

Doall Deep-Throat Type MD Metalmaster

A new Doall three-in-one contour machine with 30-in. throat capacity has been placed on the market by Continental Machine Specialties, Inc., 1301 S. Washington Ave., Minneapolis, Minn. This machine is designated as the Metalmaster Deep-Throat Type "MD". Like its companion model "M", a feature of this new designed type of machine is a built-in automatic instant butt-welder for the saws.

The new welding unit is an ingenious, compact device having features not found in the single-purpose saw butt-

IT'S A PRODUCTION MACHINE

Type S Production Polishing Machine

4 machines in one!

A Centerless Feed Polishing Machine —a Vertical or Horizontal Belt Grinder —a Surfacer or Polisher—an Internal Grinder or Polisher.

It's *the* machine for your cylindrical polishing and straight line finishing on flat work.

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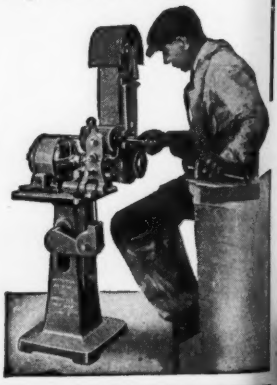
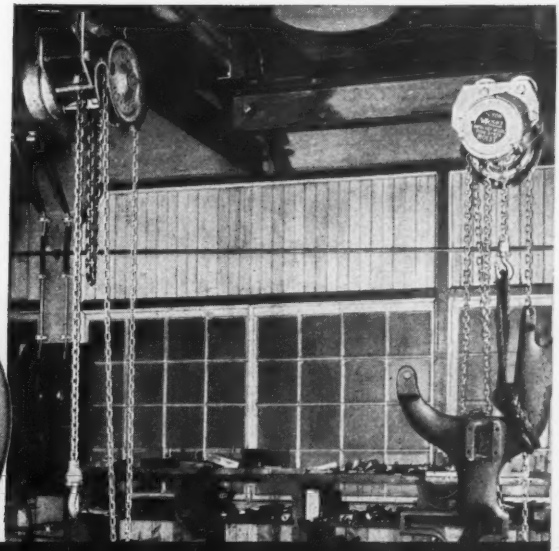
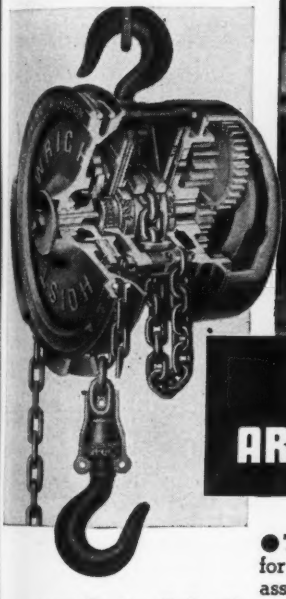


PRODUCTION MACHINE CO., Greenfield, Mass.

21 FEATURES MAKE IT RIGHT!





THESE WRIGHT HOISTS ARE *Right* FOR THIS JOB!

● These Wright Army Type Trolley Hoists are just right for the hoisting service required for machine tool assembly. . . . Designed for use where headroom is scant. Timken Roller Bearing trolley permits movement along the I-beam with little effort. Zinc coated finish defies corrosion. Ball bearings in the load wheel bearing permit exceptionally easy lifting. Safety load chain guard, special analysis, electrically welded hand chain and drop-forged hook insure absolute safety. . . . This Wright hoist is right in every one of its twenty-one features. Send for the new catalog which gives you all the facts.

WRIGHT MANUFACTURING DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC.
YORK, PENNSYLVANIA

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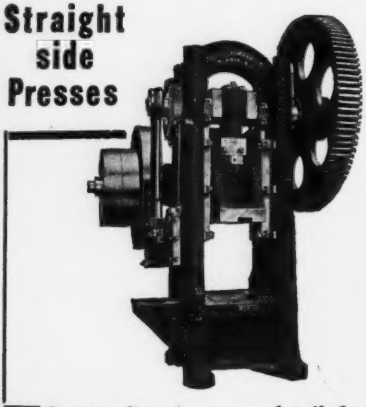
Straight side Presses



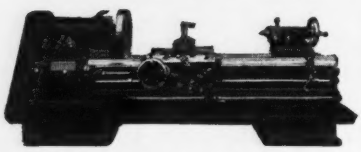
Outstanding in every detail for heavy blanking and forming work. All stresses are taken centrally.

Write for new catalog illustrating and describing this and other presses.

Zeh & Hahnemann Co.

184 Vanderpool St. Newark, N. J.

Real Production with G-K Single Lever Control Lathes



● With fewer handles or levers to operate, G-K Single Lever Control Lathes make it possible to turn out work more quickly and with greater ease.

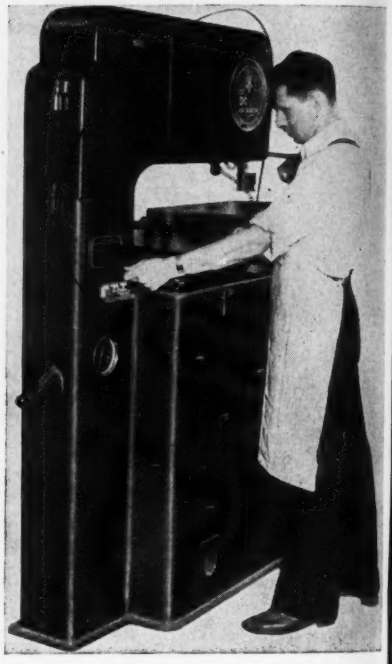
This and other outstanding features about which we shall send information make G-K Lathes ideal for the efficient shop. Write for catalog.

GREAVES-KLUSMAN TOOL CO.

CINCINNATI, OHIO

welding machines as used by band saw manufacturers. Narrow-blade saw welding requires a precision welding instrument in order to get the exact amount of current for each width of saw. This is accomplished with a voltage regulator; thus every weld is made exactly uniform. The entire butt-welding operation is done automatically by merely pressing one lever. The weld is completed instantly, and the joint is stronger than the rest of the saw.

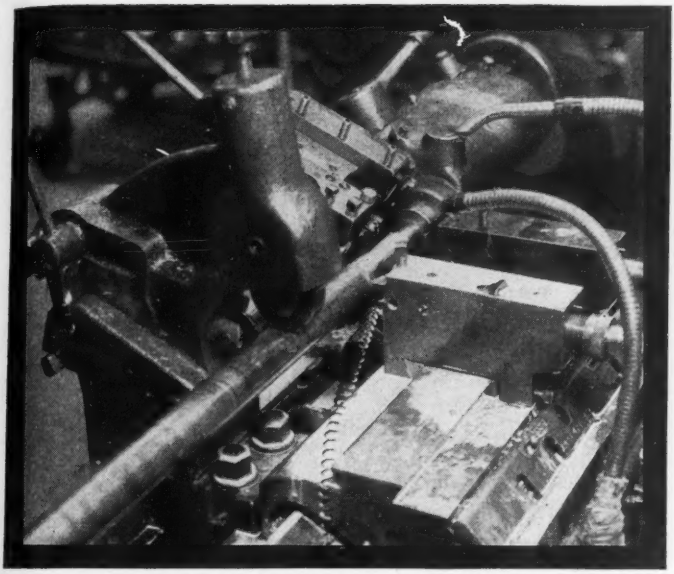
Another feature of this model is dial



Doall Deep-Throat Type MD Metalmaster

control of cutting speeds. A speed indicator records the exact speed within the broad range from 40 to 800 feet per minute. A "job selector" dial translates the correct speed to use in sawing or filing 48 different materials. An apprentice or new operator can produce exacting results with little or no training in contour machining, because of this simple control system and the automatic welding device.

This model has a new power work feed actuated by weights and levers. The



Turning front propeller shaft 45 5/16" long, diameter 1.490". Material: S.A.E. 3140, heat treated to Brinnell hardness of 302 to 340. Operations: turn 5" on outer diameter and chamfer 60° on turned end. Comparative performance of V-R Grade E and H.S.S. tools:

Tools Used	Depth of Cut	Feed	Speed	Pieces per Grind
V-R Grade E	.109"	.015"	123 Ft./M	600 to 800
H.S.S.	.109"	.010"	35 Ft./M	3 to 10

Again the superiority of Vascoloy-Ramet, the tantalum carbide tool material, is translated in terms of time and dollars saved. An amazing increase in pieces per grind, faster time from floor to floor, lowered production costs!

Produced in 17 standard grades of different tantalum carbide content, strength and hardness, V-R alone covers the entire range of machinable materials and machining needs.

Unrivalled in the machining of all steels, it stands alone as the only material capable of turning steel without "cratering." It excels in performance on cast iron, semi-steel and non-ferrous materials.

Its revolutionary performance and economies have already established V-R as the preferred tool material in small shops, and in the country's great industrial plants as well.

Write for the new V-R catalog-price list, sent upon request.

VANADIUM-ALLOYS STEEL CO.
VASCOLOY-RAMET DIVISION
NORTH CHICAGO, ILL.

VASCOLOY-RAMET

...The TANTALUM CARBIDE TOOL MATERIAL...

A GRADE FOR EVERY USE

VASCOLOY-RAMET BLANKS

Vascoloy-Ramet is available in three forms, (a) completely finished tools, (b) milled and brazed tools, and (c) blanks. V-R blanks are furnished in 5 standard styles and in sizes to meet every requirement. To make tools with V-R blanks is a simple operation, fully described in a new instruction booklet, available free —upon request.

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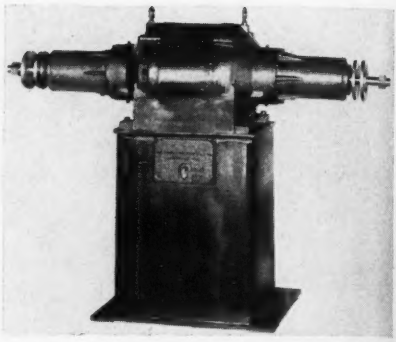
weight or pull is adjustable with a hand wheel located conveniently for the operator. Another feature of the power feed is a mechanical toggle which permits mechanically rotating the work to follow a contour, instead of guiding the contour by hand. A foot pedal permits instant release of the work feed.

The work table has four-way tilt, and a new type of detachable disc cutting unit is furnished. Work thickness capacity is 8 in., although this model, as well as the smaller Metalmaster, is made on special order to cut up to 12 in. thickness capacity.

Another feature is the use of arc welded steel construction in the entire base of this machine in place of castings. This welded housing is seasoned before machining. This construction carries out the clean styled appearance of the Doall and gives other well known advantages of welded construction.

"Production" Type 322W Buffer

To meet the requirements of heavy duty buffing with unusual distance between wheels (in a "motor-in-head" type of machine), The Production Equipment Company, 5219 Chester Ave., Cleveland, Ohio, announces the Type 322W Buffer shown in the illustration. The



"Production" Type 322W 10 H.P. 3600 R.P.M. Four-Bearing Buffer

machine, which is of a heavy construction, is designed with four bearings and furnished with a spindle of very liberal size. The diameter of the spindle extension adjacent to the outside bearings is 1 13/16 in. The spindle housing sleeves are designed to allow ready assembly and disassembly.

The machines are built in ratings from 4 to 15 h.p., and are furnished with

PORTABLE TOOLS
High Frequency Electric and Pneumatic.
GRINDERS - SANDERS
POLISHERS - DRILLS
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Engineered for Efficiency
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THE BUCKEYE
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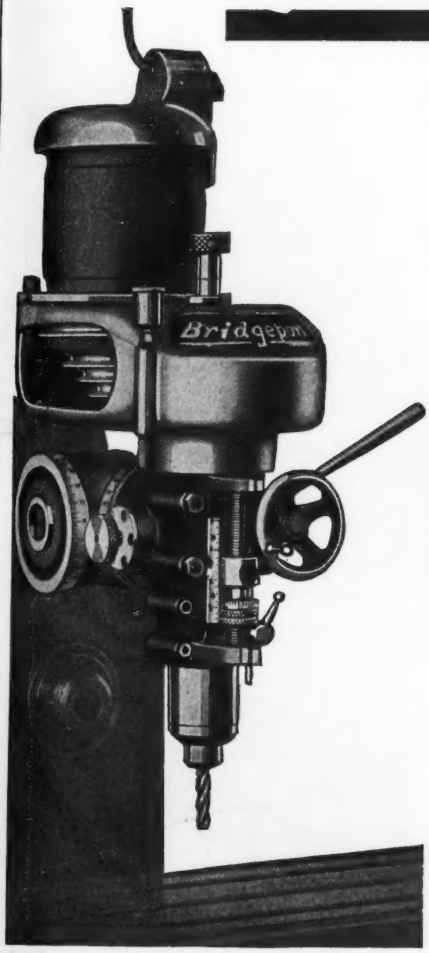


THE BRIDGEPORT "MASTER" for *HIGH-SPEED* Milling, Drilling and Boring AT ANY ANGLE

SAVE

On End Mills.
Hours of Labor.
Temper of Mechanics working with old sloppy spindles.
Special fixtures, Angle Plates and Vises.

After seven years of continuous service The Bridgeport Attachments are still giving the same matchless performance. One company alone has forty-five of these machines in use in their die sinking departments.

A number of concerns use from ten to fifteen machines each for tool and die as well as production work.

We doubt if we can overstate the value of the Master Attachment for the small tool shop where a unit of this type will solve most of the awkward time eating jobs.

LET US tell you where a Bridgeport High Speed Milling Attachment may be seen in operation. Your time in viewing this equipment will be well spent.

Write for Illustrated Bulletin.

BRIDGEPORT PATTERN & MODEL WORKS
52 REMER ST. BRIDGEPORT, CONN.

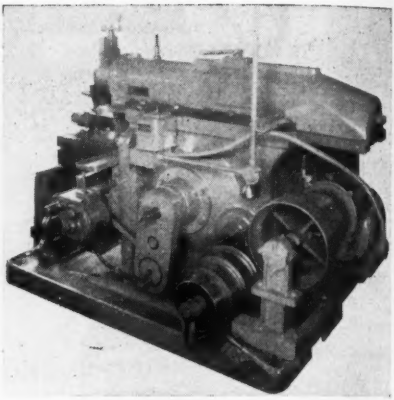
enclosed motor, flanges, nuts, safety-type spindle threads, and magnetic starter. The distance between wheels is approximately 4 in., varying slightly according to the rating of the machine.

When built in two-bearing construction, this general design is designated as Type 322. The two-bearing machine is furnished with open spindle extension and has a distance between wheels of approximately 3 in. Both designs can be supplied in any desired motor speed, but ordinarily are built for either 1800 or 3600 r.p.m.

"Production" 5 H.P., 250 R.P.M. Shaper Drive

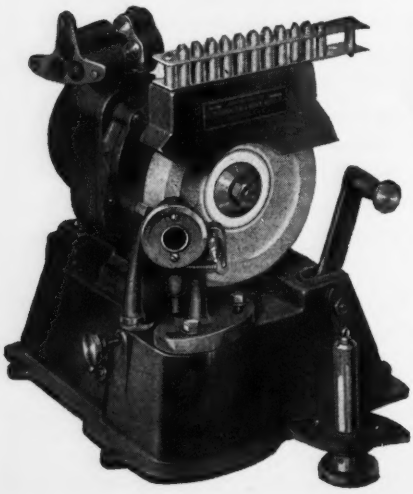
The Shaper Drive built by The Production Equipment Company, 5213 Chester Ave., Cleveland, Ohio, has been built to conform to requirements for heavy duty, and compact intallation. The general construction is similar to that used on their Type 844 drive, which is applied on lathes, screw machines, millers, and other machines which allow the supporting column to be attached to the side or the rear of the machine tool.

The drive itself consists of a geared motor with extended shaft and outboard bearing, all mounted on a rigid base. All bearings are of anti-friction type, and the gears operate in oil. The countershaft cone pulley is mounted on the extended shaft and the drive attached to



Production 5 H.P. 250 R.P.M. Type 844 Shaper Drive Attached to 26-In. Kelley Shaper

"BLACK DIAMOND" DRILL GRINDER



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You save time and money with a "Black Diamond" Drill Grinder—no complicated adjustments—an exclusive feature.

The money you save on proper "Black Diamond" Drill Grinding will quickly pay for the cost of the machine.

You'll want to know more about this time and money saver. Write for Bulletin No. 115.

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the lower rear of the shaper frame by means of special castings.

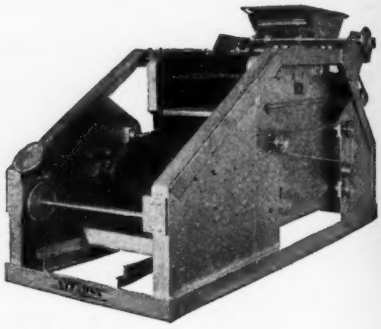
The mounting uses rigid arms at each end of the drive base and has separate arms which hold the cam release shaft, and which also provide adjustment for belt stretch. Two release cams are used, one at each end of the base so as to maintain accurate alignment of the drive under all operating conditions. These cams are provided to allow for either proper belt tension during operation, or for releasing the belt to permit shifting on the cone steps. The cams give a throw of practically 360 deg. and the cam lever is arranged on a semi-ratchet principle to allow partial throws when desired.

These pivoted drives permit the use of close pulley centers with positive power transmission to the full capacity of the machine.

Heavy duty drum starters are furnished as standard equipment. These are arranged with spring return for reversing the motor during set-ups, and with a fixed position for operating the motor in the normal direction. The motor can be plugged in either direction for quick stopping, and materially reduces the time required for either set-ups or adjustments.

Improvements in Stearns Type Q Magnetic Separator

The Stearns Magnetic Mfg. Co., Milwaukee, Wisconsin, has made some radical changes in the design of its popular Type "Q" magnetic separator. This unit has been perfected primarily for the separation of free iron from finely ground



Improvements in Stearns Type Q Magnetic Separator

They take hold

UNSHAKO

The Nut that can't shake loose

· and wont let go ·

'til you "tell" them with a wrench . . . . . .

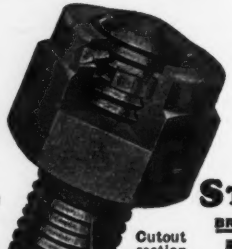
Once the "Unshako" has been fully tightened, the locking ring positively prevents its backing off.

It supplies a live, counteracting force within the nut that defeats vibration's efforts to shake it loose as effectively as could a giant hand's constant grip.

Yet . . . an ordinary wrench, applied without undue effort, will back-off the "Unshako" as smoothly as you please.

Every "Unshako" Self-Locking Nut is a self-contained unit . . . no extra washers, pins or other gadgets to bother with.

Send for literature.



Pat'd. and Pat's. Pending Fig. 1510

Cutout section showing Locking Ring in place.

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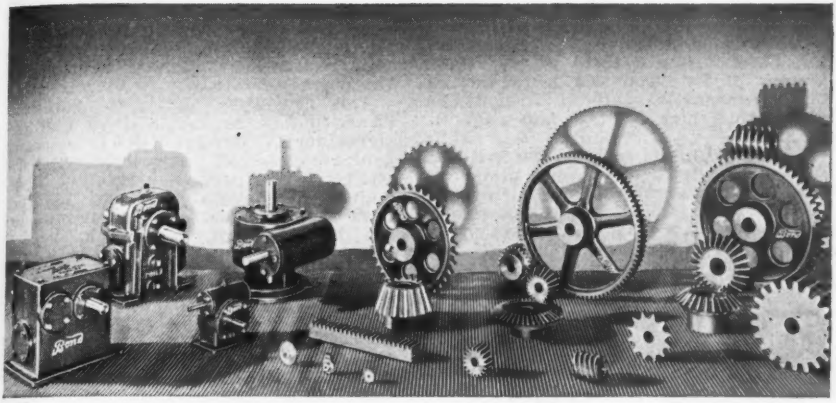

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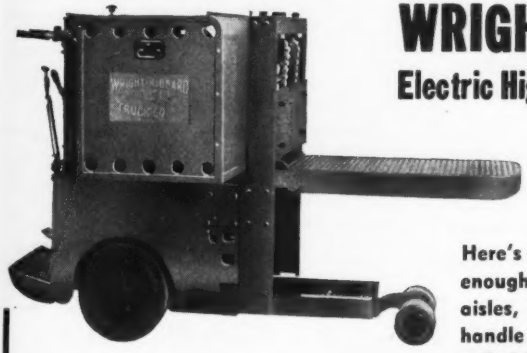

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COMPACT
STRONG

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Maximum lift—72". Loading platforms—18" to 28" wide and 34" to 53" long.

Write for catalog No. 5 for further details on the high-lift truck. Information on other trucks on request. Write today.

WRIGHT-HIBBARD INDUSTRIAL ELECTRIC TRUCK CO. PHELPS • NEW YORK

material by an inductively magnetized vibrating screen. It provides an efficient separation of unusually large capacity for material where there is very small percent of free iron and large amount of non-magnetic material without an appreciable loss of the non-magnetic material.

The new unit is entirely enclosed and self-contained. The feeder has been lowered for greater convenience where hand labor is used. Roller bearings of rugged construction are now used throughout. Adjustment of the vibrating screen belt has been arranged to allow alignment by a single operation and insures absolute alignment of the belt on the pulleys at all times. The vibrator mechanism has been redesigned to provide for changing the degree of intensity in vibration.

This new Type "Q" is furnished for either pulley, or motor drive and designed for DC current. Where necessary generator sets can be provided. The capacity of the particular machine illustrated is approximately 4000 lbs. per hour of material 200 mesh, weighing 100 lbs. per cubic foot.

Fellows Enveloping Gear Generator

A machine for finishing gear teeth by a method known as the enveloping generating process, shown in Fig. 1, has recently been announced by the Fellows Gear Shaper Company, Springfield, Vermont. The principle employed in removing metal by this process differs from conventional gear cutting methods: (1) the tool and work are rotated together without control by any indexing mechanism; (2) cutting is accomplished by setting axes of tool and work askew to each other and by bringing the tool into intimate contact with the work under pressure; (3) the tool is rotated at high speed and traversed at slow speed, first in one direction to finish one side of the teeth, then reversed, and rotated and traversed in the opposite direction to finish the other side of the teeth. When tool reciprocation is not restricted the tool is traversed for a distance slightly greater than the gear face width, and one complete cycle finishes the gear.

In cases where full face width reciprocation is restricted by a shoulder, the work is fed steadily upward into the tool, the latter being reciprocated about 1/32 inch, to enhance the cutting action and improve the finish. This upward feeding action continues for a predetermined time, the tool making one or

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THE IMPROVED STA-KOOL DIAMOND HOLDER

Patented fin construction permits greater radiation — increases efficiency in the dissipation of heat.

Tool protected by U. S. Patent No. 2047147

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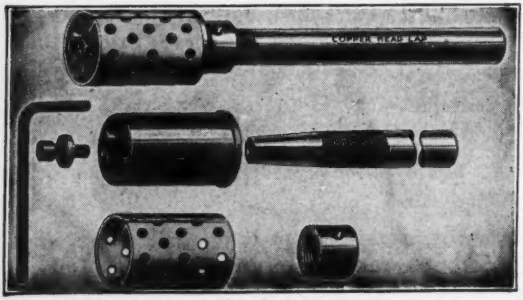

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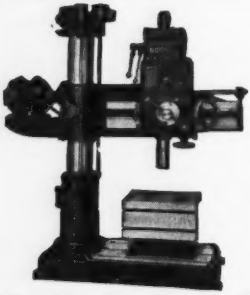

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more cycles, depending on amount of material to be removed.

Tools used on the No. 8 Enveloping Gear Generator are made in a variety of types depending upon the character and shape of the work and other conditions. The two-piece type of tool, shown at the top in Fig. 2 for finishing spur and helical gears, can be used where there is no interfering projection on the work.

Two other types of tools are shown

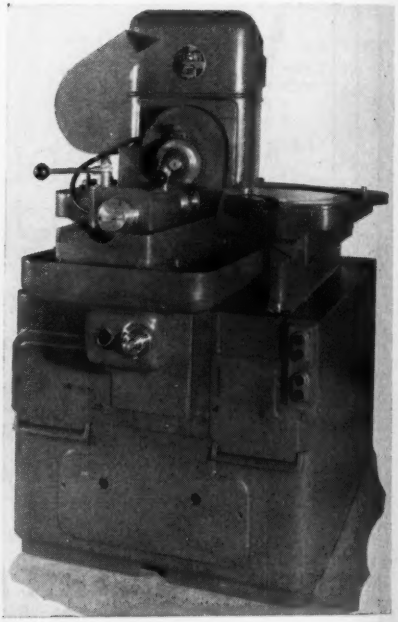

Fig. 1.—No. 8 Enveloping Gear Generator for finishing spur and helical external and internal gears.

in Fig. 3. The one at left is known as the one-piece "slotted" type. This tool is made with deep angular slots cut to the full depth of the teeth and on a helix, thus producing a multiple number of cutting edges. It is very free cutting and is especially adapted to the cutting of shoulder gears. Because of its design, it is ideal for semi-finishing where the character of the work requires two finishing cuts. When used for final finishing, the tool is ground to envelop the work.

The tool at the right, Fig. 3 is of

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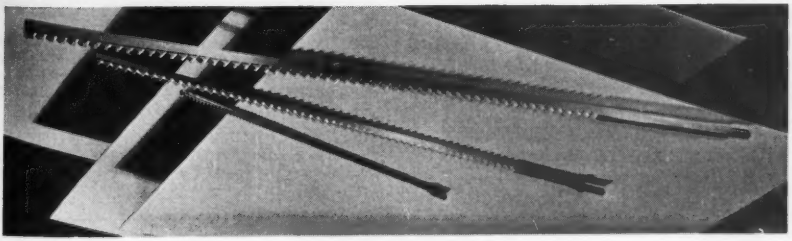

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the "serrated" tooth type. A series of shallow grooves are cut on both sides of the teeth, thus presenting a multiplicity of cutting edges to the work. This tool is particularly suited to final finishing. All three types of tools shown in Figs. 2 and 3 are made to envelop the work when conditions warrant.

The machine is automatically lubricated and is provided with sight-feed oilers. A reservoir in the slide lubricates the slide and gibs, and a reservoir in the knee performs a similar function for the knee and connecting members.

This machine is arranged for complete electrical control. The main motor which is located in the base is 1 h.p.,

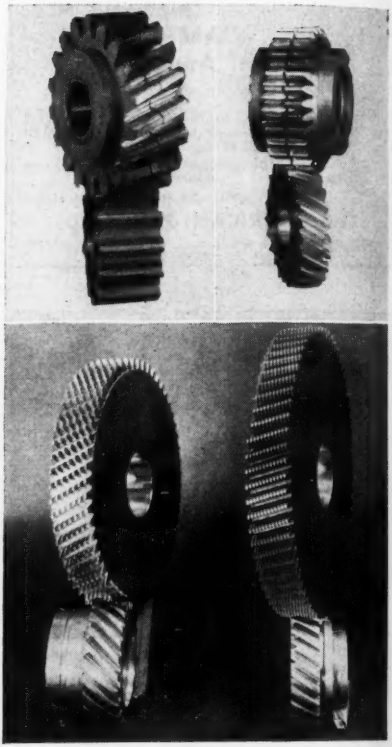

Fig. 2.—(Above)—Two-piece type of Enveloping Generating Tools used for finishing spur and helical gears. Fig. 3.—(Below)—One-piece Enveloping Generating Tools of the "slotted" and "serrated" tooth types.

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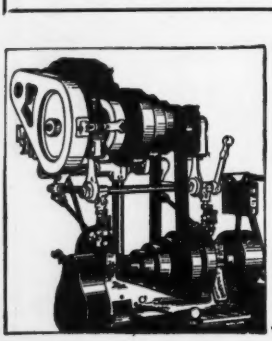

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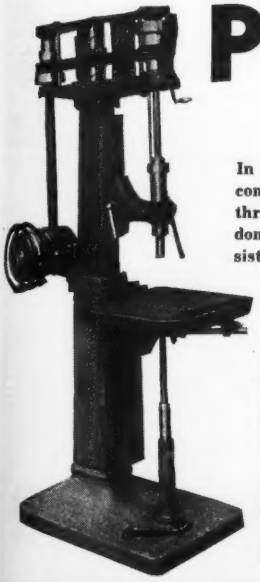

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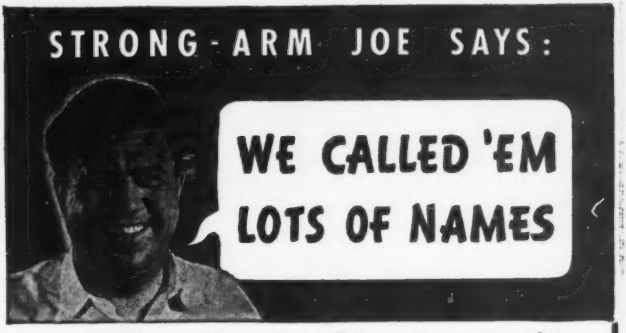

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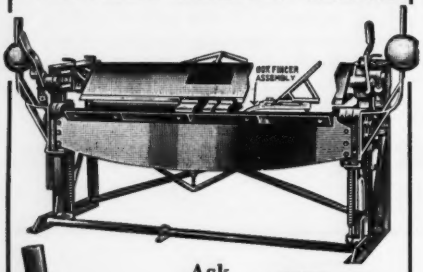

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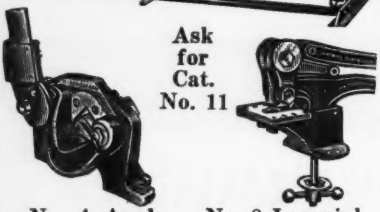

No. 4 Angle Iron Shear

No. 8 Imperial Punch

Whitney Metal Tool Co.

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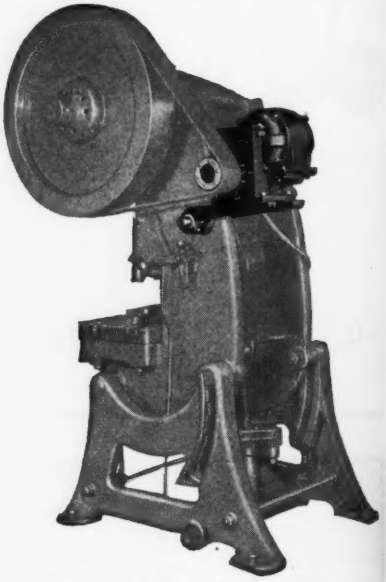
Cullman Punch Press Drive

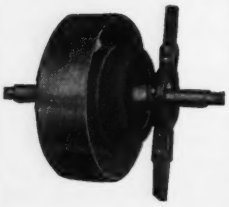
Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill., has brought out a motor drive attachment especially designed for use with punch presses. A standard type punch press to which a Cullman Punch Press Drive has been attached is illustrated herewith. The drive consists of the motor, a speed reducer, drive pulley, and the mounting brackets by which



Application of Cullman Punch Press Drive

"EDGEMONT" SERVICE TESTED FRICTION CLUTCHES

EXPANDING "TYPE B"



Adapted to a wide range of drives such as countershaft, line-shaft, and machine applications with moderate speeds. A simple, efficient, and inexpensive clutch.

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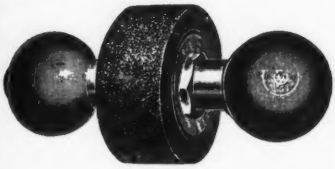

Dresses any wheel up to 14" diameter. Makes the surface true and even. Does not grab or tear the wheel. Cuts out bond or filing and leaves cutting paticles standing out sharp and clear. Brings up corner on thin wheels. Prevents chipping of the wheel.

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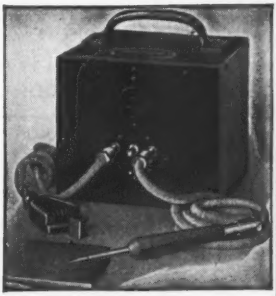

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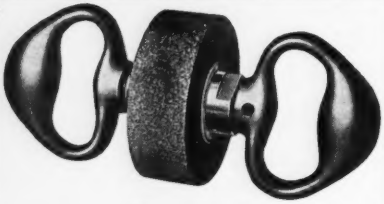

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It will:

Keep your grinding wheels accurate and fast cutting.

True a square, bevel or "v" edge without chipping or breaking the wheel.

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DESMOND-STEPHAN MFG. CO.
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it is attached to the column of the press.

The punch press drive, as other Cullman drives, is an individual electric motor unit designed to eliminate countershafts and belting, making the machine entirely self-contained. The installation requires practically no alteration of the machine, four bolt holes being required to complete the usual installation. The sprocket shafts are supported by removable cast iron bearings revolving on cast iron in a bath of oil and are enclosed in an oil and dust-proof housing.

The flywheel speeds are determined by the sprocket ratio in the speed reducer and size of the driver pulley. The punch press drive is made in four sizes; ½ h.p., 1 h.p., 2 and 3 h.p., and 5 h.p. In addition to the advantages which are inherent in the individual drive, an advantage of this unit consists in the saving which can be made in the cost of 1800 r.p.m. motors over 600 or 900 r.p.m. motors. Also, by using the large driver pulleys, the belts will have more driving surface, which means greater efficiency.

Challenge Abrasive Cut-Off Machine

The Challenge Machinery Co., Grand Haven, Mich., has recently marketed a new Abrasive Cut-Off Machine that will cut any metal hard or soft, tubular or solid. It is said to cut hardened tool steel easily and quickly.

This Challenge Abrasive Cut-Off Machine is a self-contained utility unit in the moderate-price class. It has a capacity up to one inch thickness. The table is adjustable and measures 15x14 inches. Gauges are conveniently located and easily adjusted. The base is cast iron. The machine comes equipped with a 6x1/32x½-inch elastic cut-off wheel

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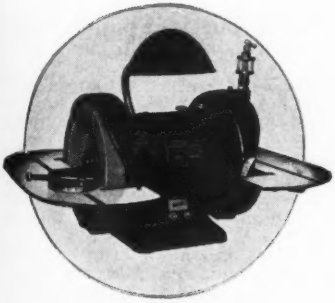

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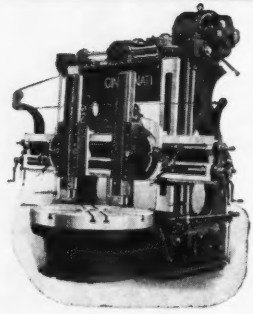

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and has a precision ball bearing spindle. The outfit may be plugged into any light socket. Furnished either with or without steel stand.

Either a 110 or 220-volt, single phase A.C. motor is included in the price of the machine.

Challenge Abrasive Cut-Off Machine

Hunt Bronze Forged Pilot-Operated Hydraulic Valve

C. B. Hunt and Son's Company, Salem, Ohio, has brought out a new bronze-forged pilot-operated hydraulic valve, the design of which embodies the same no metal-to-metal wear principle and minimum of moving parts as characterizes this company's already well known line of "Quick-As-Wink" Air Control Valves.

The illustration shows bronze forged housing valve pilot operated, for 4-way operation. Also built for 2-way and 3-way. Made in ½ in., ¾ in., and 1 in. sizes, in two styles, for 1000 pounds working pressure and for 2000 pounds working pressure. The bronze forgings used as housings are among the largest bronze forgings ever made. The employment of the dropped forged bronze housing with its high physical strength affords an additional factor for long life with water or corrosive fluids.

In the "Quick-As-Wink" valving principle, the valving operation is accomplished in the 2-way valves by only one moving part; in the 3-way and 4-way valves by coincident motion of the two valve bodies or plungers. The valve

This is one way to count

production of pieces. A much more reliable and time-saving way is to make your machines count as they produce by putting Durant Productimeters on them. We have counters for any type of metal working machine and any field of industry.

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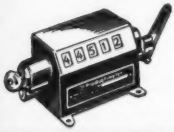

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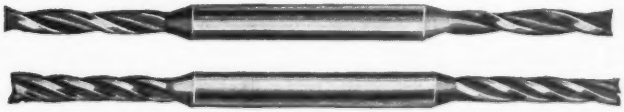

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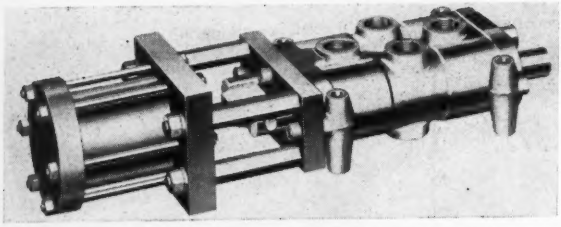


Hunt Bronze Forged Pilot-Operated Hydraulic Valve

bodies or plungers are made of stainless steel. These are "free-floating" in special packings, avoiding metal-to-metal contact. Balanced port action in conjunction with the valving ring and the no metal-to-metal contact, is claimed to provide a combination for extremely long life and satisfactory performance in hard service. Short travel is an aid to easy operation.

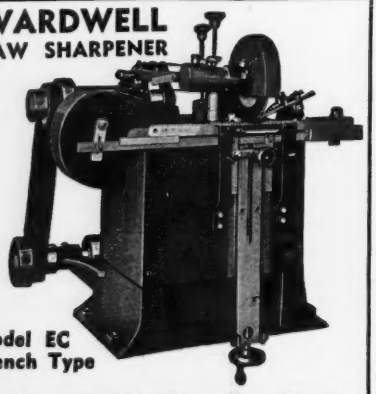
Accessibility is such the complete inspection, replacements of parts and reassembly can be made in a few minutes without disturbing the hydraulic piping. Connections are provided so that the piping may be permanently connected above or below housing. The only internal moving parts, the stainless steel valve bodies or plungers, in several years of hard, continuous service have shown imperceptible wear due to valve action, in millions of operations.

Sheldon 10-In. Lathes with Under Motor Drive

Sheldon 10-in. Lathes, product of Sheldon Machine Co., 3255 Cottage Grove Ave., Chicago, Ill., can now be furnished with an Under Motor Drive Attachment either in a cabinet leg, as illustrated, or the unit can be attached directly to the under side of a bench where a bench type lathe is wanted. The unit provides four speeds by means of two positive clutches on the drive shaft. These clutches are operated by the two levers shown in front of cabinet leg.

There are eight spindle speeds, four direct and four thru backgears, and in making these speed changes it is only necessary to turn the clutch levers.

WARDWELL
SAW SHARPENER



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Bench Type

Automatically Sharpens Hack, Band & Circular Saws
with teeth as fine as 32 to the inch, at a speed of 30 to 75 per minute.
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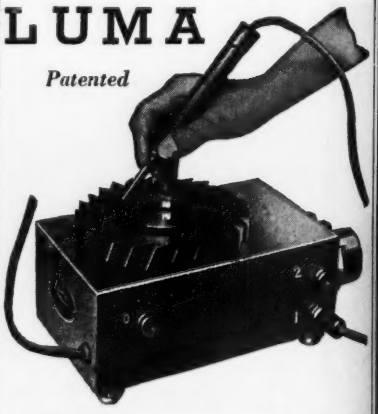

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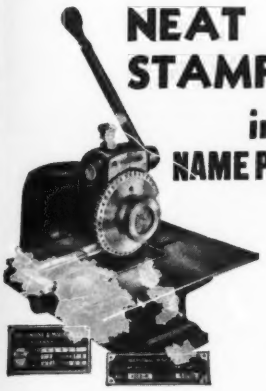
NEAT STAMPING in NAME PLATES



This machine quickly stamps details and serial numbers into name plates.

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1806 Belle Plaine Ave., Chicago, Ill.

LAUBER PATENTED Die Cast File Handles

- Heavy ferrule die cast directly on hard wood.
- Can't turn or become loose.
- Holds file firmly.

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SENSATIONAL *NEW* DEVELOPMENT

EVANS REAMERS

SURPASS ALL.
HIGH SPEED STEEL.

No Honing.
Chrome Like Finish.

50 to 80 thousandths expansion.
Full Bearing Surface.
Perfect Alignment.
Will not chatter.
With Left and Right Spirals.
It can not fall in slots or oil grooves. Extension Pilots for Line-up Work.

3-SPEED REAMER DRIVE

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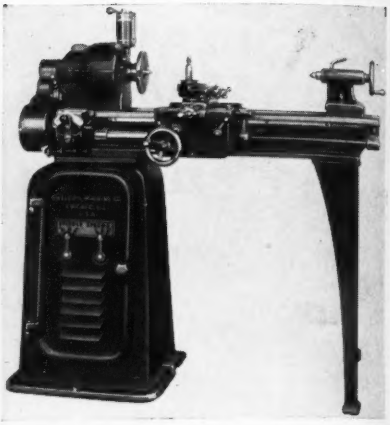
FLEXIBLE REAMER CORP.
3656 Lincoln Ave., Chicago, Ill.

There are no belts to shift, no doors or guards to open or remove. The cabinet leg is provided with a large door to enable the operator to oil the unit and adjust the V belt tension when necessary.

Sheldon 10 in. Lathes swing 10¼ in. over the ways and are furnished in two bed lengths, giving 20 in. and 26 in. maximum center distance. The spindle runs in bronze bearings, has a 1 1/16 in. hole, and round collets up to ¾ in capacity can be used. All 10-in. lathes are furnished with semi-quick change gear boxes containing the necessary gears for cutting threads from 4 to 80 per inch. Either Plain or Worm Feed and Power Cross Feed Aprons can be furnished.



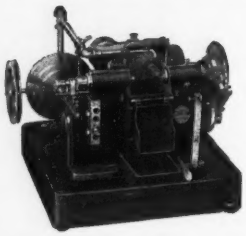
Sheldon 10-In. Lathes with Under Motor Drive

Reed-Prentice No. 5 Vertical Miller and Die Sinker

The No. 5 Vertical Miller and Die Sinker shown in the illustration has been placed on the market by Reed-Prentice Corporation, Worcester, Mass. This machine is equipped with a helical gear drive to the spindle and the entire top gear box of the machine is equipped with helical gears mounted on Timken bearings, replacing the previous belt drive construction.

The working surface of the table is 68x16 in., the distance between the three T-slots being 5 in. The throat depth is 20 in. and the distance from the center

"Waltham" Pinion Cutting Machines



Are made with a variety of equipments. They will make the two or three successive cuts needed for watch pinions or may be used for fine pitch gears up to 1½" diameter. There is also a 4" size. If you will describe your work we will send details.

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HIGH SPEED SCREW SLOTTING SAWS

Circle "R" high speed screw slotting saws are made from the finest steels and are hardened and tempered correctly to give maximum service under the most severe usage. SPECIFY CIRCLE "R" SAWS.

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Made by F. L. Grobet Leading precision file manufacturer.

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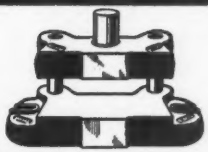

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The Standard Dial Indicator has a high "face value". Its new Shockproof construction protects delicate mechanism from shocks that would destroy the precision of the average Dial Indicator.

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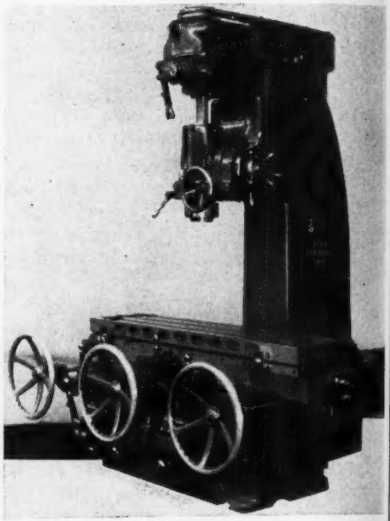
POUGHKEEPSIE • NEW YORK

line of the spindle to the face of the column is 11¼ in. Longitudinal power feed, 48 in.; cross power feed, 16 in. Rapid power traverse in either direction, 100 inches.

The vertical adjustment of the head on the column is 15 in. and the vertical feed of the spindle is 9 in. Maximum distance from end of spindle to table, 30 in. Eighteen spindle speeds are provided, the standard range being from 17 to 600 r.p.m. The high speed range is from 34 to 1200 r.p.m. Eight feeds are provided, the feed range for 18 speeds being from 0.002 to 0.297 inch.

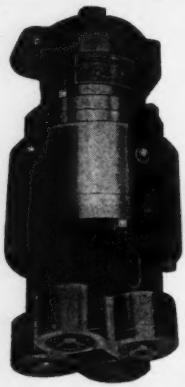
The hole through the spindle is 1 1/16 in. diameter and the taper hole is N.M.T.B.A. standard of 3½-in. taper per foot with a No. 10 B & S adapter. The spindle sleeve is 6-in. diameter and 20-in. long. The height of the machine above floor is 33 in. and floor space required is 115x30 in. Shipping weight, 11,500 pounds.



Reed-Prentice No. 5 Vertical Miller and Die Sinker

Atlas 7-In. Bench Shaper

The line of back-geared lathes, sensitive drill presses, and mechanical and hydraulic arbor presses built by Atlas



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● U. S. Multiple Drill Head Units quickly convert any single spindle drill into a multiple unit. Thus, you are assured more holes per minute and larger profits.

Send blue prints for estimates.

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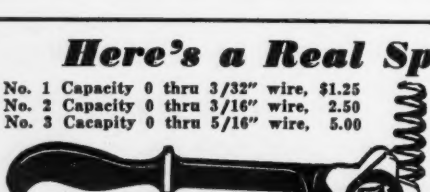
Here's a Real Spring Winder!

No. 1 Capacity 0 thru 3/32" wire, $1.25
No. 2 Capacity 0 thru 3/16" wire, 2.50
No. 3 Cacapity 0 thru 5/16" wire, 5.00



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The HJORTH Perfection Spring Winder offers the ideal means of winding extension, compression, torsion, taper, double taper, or left hand springs. Try one in your shop. You'll like it and the price is reasonable.

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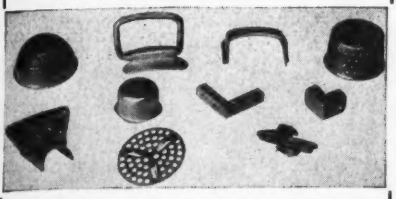

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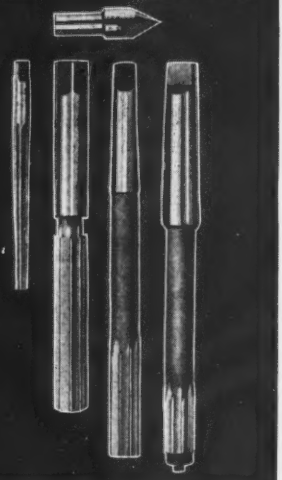

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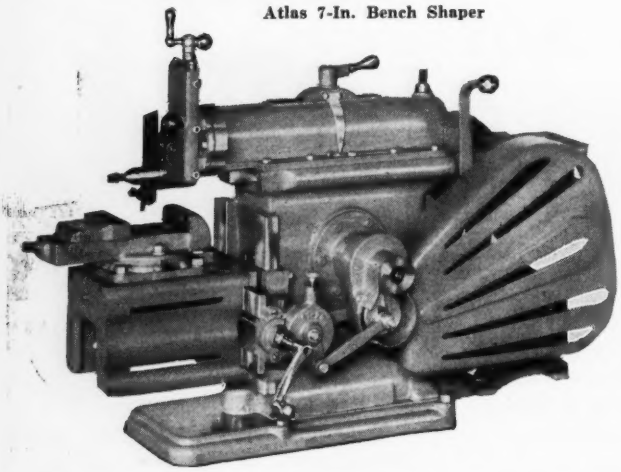
Atlas 7-In. Bench Shaper



Press Company, Dept. 4, Kalamazoo, Mich., has been augmented by the addition of a 7-in. bench shaper. The shaper, illustrated herewith, is specially intended for improved efficiency, economy and versatility on small work.

The design of the shaper incorporates accepted principles of modern shaper construction. The ram driving mechanism is of the bull-gear type; the stroke (quick return) is from ½ to 7⅜ in. Four speeds of from 45 to 200 strokes per minute are available through a V-belt drive from the motor to the bull-gear spindle. Five feeds in either direction of between 0.005 and 0.025 in. per stroke are available with an automatic cross feed. Cutting speeds are from 3½ to 116 ft. per minute. The maximum table travel is 8½ in. horizontal and 4½ in. vertical. The maximum distance from the table to the ram is 5⅛ in. and the minimum distance is ⅝ inch.

The shaper is designed to be operated from a ½ h.p., 1740 r.p.m. motor. A

Improved Anderson
Balancing Ways
No Leveling Required

A simple and excellent device for balancing, straightening and trueing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000

Four Chilled iron discs rotate on sensitive special bearings

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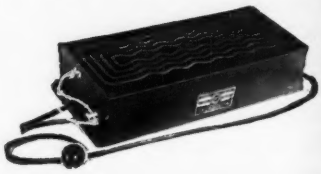
Made by **Anderson Bros. Mfg. Co.**
1926 Kishwaukee St., Rockford, Ill.

NEW "D&W" MAGNETIC CHUCKS

Styles 7x17 and 6x13



Developed to meet demand for chucks lower than our standard style.

Send for folder covering Chucks and Demagnetizers.

J. & H. ELECTRIC CO.
202 Richmond St., Providence, R. I.

"More For Your Money" is the title of a six-page folder featuring Hobart Selective Motor Horsepower Control with which current costs are reduced, power factor is improved and amount of starting current required is reduced on the arc welders built by Hobart Bros. Co., Troy, Ohio. The folder includes a checking chart with which the user of arc welding equipment can check up on arc length, penetration, fusion, tenacity, and the rest of the twenty points upon which the Hobart Arc Welder is said to excel. Features of the Hobart 40-Volt Simplified Arc Welder are explained in detail and the text is profusely illustrated. Copy free upon request.

Explosion Tested D.C. Motors. Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., is now issuing Leaflet No. 20652 describing and illustrating the Westinghouse Explosion-Tested Fan-Cooled Totally-Enclosed Type SK Direct Current Motors. The Type SK Motor is designed for use in locations where explosive gases or dust may exist. The motor is designed to give the maximum of service and operate with a minimum of maintenance. It is built in sizes from 5 to 75 H.P. and to operate on 115, 230 and 550 volts.

A feature of the motor is accessibility, which is obtained by the use of a double walled bracket on the commutator end. The bracket is equipped with hand hole covers which are readily removable to permit inspection and adjustment of the brushes and commutator. The fan is on the commutator and provides efficient ventilation because the flow of cooling air is not restricted by pulleys, gears, gear cases, and so on. In addition to the feature, the motor is built into a rolled steel frame, has vacuum impregnated field coils and mica insulation on the armature coils.

The Type SK motor is designed, built and tested to stand an internal explosion of gas (methane) or coal dust without injury to the equipment or without emitting flames or sparks which would ignite surrounding gas. The fan on the commutator end forcing a large volume of cooling air through properly located air passages makes possible high continuous capacity with minimum size. To guard against the covers being removed by unauthorized persons, each cover is provided with a hole in the web for insertion of either a wire metal seal or chain and lock. Copy of the leaflet is available upon request.

WIREGRIP BELT HOOKS

Now you can get your belt hooks on processed card (Pat. Applied For). Not only protects fingers from sharp hooks but holds them to the last hook in correct position. There's no card end waste with WIREGRIP—easily cut to size with scissors or knife. Coming in all sizes, easily applied with a WIREGRIP Lacer or any other standard lacing machine.

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CENTERLESS GRINDING

Accuracy—Prompt Service

Commercial Centerless Grinding Co.
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CLARK TRUCKS

Electric Welded Construction Thru-out

Tote Pan Truck—Capacity, 1000 lbs. Self-loading and unloading. Picks up pans singly or nested. Available for all standard sizes of tote pans.

Scrap Truck—Top length 46". Bottom length 27½" Depth 18½". With single caster in rear or lockpin for Clark Lift Jack Unit. Standard and Special Trucks for Every Purpose.

ALL STEEL WELDED TRUCK CORP.
1123 RAILROAD AVE. ROCKFORD, ILL.

"Shapers by Gould & Eberhardt" is the title of a 34-page book describing the line of tool room and manufacturing shapers built by Gould & Eberhardt, Irvington, Newark, N. J. Each type and size of shaper made by this firm is illustrated and described, also each individual unit of the various machines. Phantom views are included showing the internal mechanism, double crank gear transmission, precision lubrication system, and so on. Copy free upon request.

Ajax Flexible Couplings. The Ajax Flexible Coupling Company, Westfield, N. Y., presents in bound form, a collection of data sheets covering the many types of flexible couplings manufactured by this company for the convenience of the engineer, draftsmen and purchasing agent. The contents are confined to the presentation of technical data which will be of real value to those responsible for the design and specifications of equipment. Included, in turn, are descriptions, blue print drawings, specifications, and installation photographs of the Ajax Type S, Type F, Type SP, and Special Ajax Couplings. Copy free upon request.

Dardelet Self-locking Threads; Bulletin No. 17. This bulletin now being issued by Dardelet Corporation, 55 Liberty St., New York, N. Y., presents the use of the Dardelet Self-Locking Screw thread on cap screws and set screws. The text explains how the Dardelet thread remains locked after having been tightened into the locked position whether there is full load on the fastening or no load at all. The locking action is said to be maintained continuously, regardless of changes in load stress or friction against the work bearing surface of the fastening. The bulletin is illustrated with cross-section views of cap and set screws locked and unlocked, photographs of mechanisms in which the Dardelet thread is used, and so on. Copy of the bulletin free upon request.

Barnes Piston Feed Pump. This six-page circular, now being distributed by W. F. and John Barnes Co., Rockford, Ill., presents the Barnes Piston Feed Pump for hydraulic equipment. This circular is one of a series, each profusely illustrated and dealing with a single phase of the Barnes patented hydraulic structure and system, showing step by step those features of design and construction which are the result of years of research and actual field performance.

The complete series includes pamphlets describing the gear pumps, panel mountings, control valves and fluid circuits, and structural mountings, various types of drives and fluid reservoirs. Copies of the entire series can be had by addressing the W. F. and John Barnes Co. as above.

Fairbanks-Morse Steam Pumps, described in Bulletin 6205, are suitable for a wide range of pumping applications. They have been designed to pump water, oil and similar liquids at pressures up to 420 lbs. per sq. in. in quantities up to 464 gal. per min.

Both the F-M General Service and Low Service steam pumps are of the duplex pistons pattern type. General Service units are offered in one-piece and two-piece patterns. In most sizes of Low Service pumps, the steam and fluid ends are cast separately, then assembled, forming the two-piece pattern.

Numerous refinements in design and construction contribute to the extra dependability and efficiency of Fairbanks-Morse pumps. Accurately made parts are carefully assembled by experienced workmen, and completed pumps must satisfy rigorous tests before leaving the factory. Copy free by addressing Fairbanks, Morse & Co., 910 S. Wabash Ave., Chicago, Ill.

Larger Stellite Hard-Facing Booklet. A new and more complete edition of the booklet, "Hard-Facing with Haynes Stellite Products", is now being issued by Haynes Stellite Company, Kokomo, Indiana, a Unit of Union Carbide and Carbon Corporation. This booklet describes well over 500 money-saving applications of the hard-facing process.

This new edition is the fourth printing since the booklet was originally published a little more than three years ago. Over 35,000 copies have already been distributed. New sections present information concerning special Haynes Stellite J-Metal cutting tools and an improved welding technique for fabrication of equipment employing the corrosion-resistant Hastelloy alloys. A number of examples of hard-facing automotive and aircraft valves and valve seat inserts, and the use of Haynes Stellite trim for high-temperature, high-pressure steam valves, are now also described in detail.

Copies are available without obligation from Haynes Stellite Company, Kokomo, Indiana.

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COLONIAL
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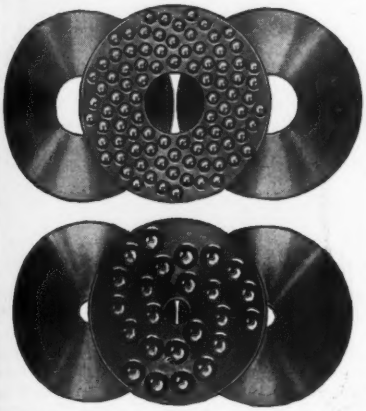

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Special Bearings Made To Order—Any quantity "one bearing or one thousand".
Your present bearings duplicated. Send sketch or worn sample, regardless of condition, for quotation.

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Successful Ways
TO CUT
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HERE is a plant, for example, that makes scissors. The problem was to remove scale, salts and oil picked up in the hardening operation. Their old method cost as much as $56.00 per batch of 502 baskets of work. Then a simple change to Oakite methods and materials cut this cost to $32.50! Nearly half the former figure!

Another plant was up against removing an obstinate ground or primer coat as well as the surface or top finish. Even two days boiling in a strong alkali didn't do the job right. And now, in the easy, sure Oakite way, this work is done successfully in six hours.

Find out what economies Oakite cleaning can make possible in your plant. Ask to have our nearby Service Man call and discuss this important matter with you.

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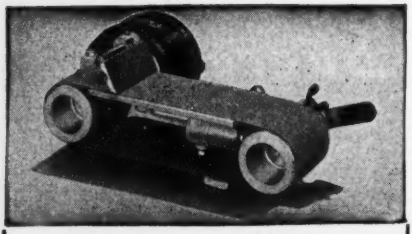
OAKITE PRODUCTS, INC.
36 Thames St., New York, N. Y.

OAKITE
SPECIALIZED INDUSTRIAL CLEANING MATERIALS & METHODS



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"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with ALEMITE LUBRICATION complete with grease gun.

Write for illustrated folder on this and other styles and sizes.

HORMEL-M GRINDER

WALLS SALES CORP.

86 WARREN ST. NEW YORK, N. Y.

CHAMPION PORTABLE VISE STAND

A Movable Bench

Very Substantial

A great convenience in Assembling Rooms and Repair Shops.

Especially adapted for Automobile Repair Shops.

Made in two sizes.
Furnished with and without vises.

Catalog upon request.

The Western Tool & Mfg., Co.

SPRINGFIELD, OHIO

floor stand is available. All bearing surfaces are large and accurately finished, and complete provision is made for adequate lubrication.

Fellows No. 4B Gear Burnishing Machine

A new type of gear burnishing machine which is designed to handle small fine-pitch gears, two at a time, has recently been placed on the market by the Fellows Gear Shaper Company, Springfield, Vermont. This machine, shown in Fig. 1, possesses several unique features: (1) it is arranged electrically so that it is impossible to bruise the teeth of fine pitch gears. This is accomplished by bringing the gears to be burnished into rotative contact with the burnishing gears before pressure can be applied, (2) four "idler" and one driven burnishing gear are used, making it possible to burnish two gears at a setting, (3) the

Fig. 1.—Fellows No. 4B Gear Burnishing Machine for burnishing small fine-pitch gears.

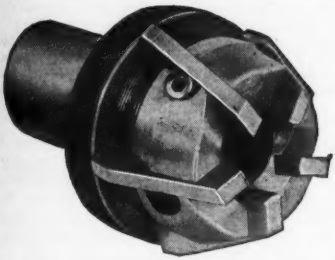
SYRACUSE D NEW YORK

DIEFENDORF

. . . for all types of gears.

When you want gears, you will save time and money by sending your inquiry to **DIEFENDORF** . . . . Cutters of all types of gears . . . . . from all metals and other materials. Let us quote on your next requirement.

DIEFENDORF GEAR CORPORATION
Syracuse, New York



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SEVEN DIFFERENT STYLES

Have Genesee cut your costs. We design and manufacture hundreds of special and multiple operation production tools. Send samples or blueprints now.

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141 No. Water St., Rochester, N. Y.

YOU SAVE
with
The Cincinnati
LINE

Offset Spindle, Ball Bearing Lathe Grinder.

Portable Electric Grinder.

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Heavy Duty Electric Drills.

Write for copy of New Catalog.

THE CINCINNATI ELECTRICAL TOOL COMPANY
DIVISION OF R. K. LE BLOND MACHINE TOOL CO.
CINCINNATI ● OHIO

slides carrying the idler burnishing gears are independently operated, so that two gears of different diameters can be burnished at the same setting.

Reference to Fig. 2 will show that the idler burnishing gears are held on adjustable studs on slides, the position of which relative to the driver burnishing gear is controlled by a cam and adjustable cam bars. The cam and cam bars are used to set the slides so that the gears to be burnished, when in the loading and unloading position, are in mesh with the burnishing gears with sufficient backlash to permit easy insertion and removal of the work. Then when the operating lever is shifted to the burnishing position, the cam is relieved from the cam bars, allowing the

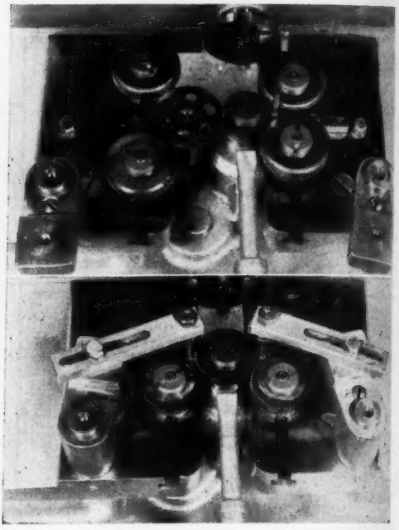


Fig. 2.—(Above)—Close view of Burnishing Gears and Operating Slides—two gears of different diameters being burnished at same setting. Fig. 3.—(Below)—Burnishing Helical Gears—Note adjustable stops to prevent endwise motion of gears when burnishing pressure is applied.

weights at the rear of the machine to apply the necessary burnishing pressure.

The work when being burnished is held on studs which locate it in the proper relation to the burnishing gears. For the ordinary run of work, these supports are held in adjustable bars lo-

Cut Cost

of removing
BROKEN TAPS
with

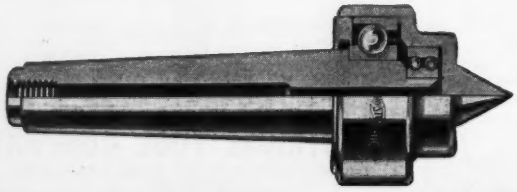
WALTON TAP EXTRACTOR

Here is a practical indispensable tool for removing broken taps quicker than any other known method. When the tap breaks off at or below the surface of the work—simply insert the Walton Tap Extractor's fingers into the flutes of the broken tap and back it out, with no damage to the threads. This tool will usually pay for itself in removing the first broken tap.

Try it on 60 days free trial offer. Send for descriptive circular and price list No. 120

THE WALTON COMPANY
98 Allyn St. Hartford, Conn.

STURDIMATIC LIVE CENTER for LATHES, GRINDERS and MILLING MACHINES



It turns with the work. Eliminates friction of dead center.
Lowest possible overhang prevents vibration and chatter.

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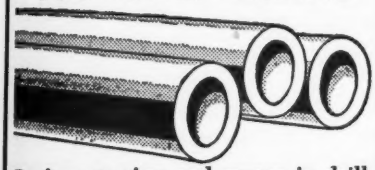
STURDIMATIC TOOL COMPANY 5222 THIRD ST., DETROIT, MICHIGAN

BISCO
TOOL STEEL TUBING



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We also supply: Stainless Tubes, Aircraft Tubes, Mechanical Tubes, Pressure Tubes and Ball Bearing Tubes. Cold Finished Steels.

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For Wheel Dressing Efficiency and Economy

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GRAND RAPIDS COMBINATION
DRILL & TAP GRINDER

. . . correctly sharpens drills and taps for faster cutting, for greater production between grinds, for all around better work. No complicated chucking mechanism. Correct convex clearance. Automatically places drill at correct angle against face of wheel. 4 sizes. *Write for catalog.*

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cated in the slides. For very small gears, special supports are attached to the slides, the design of these supports being governed by the size and shape of the work. In burnishing helical gears, as shown in Fig. 3, adjustable swinging supports are employed to prevent endwise movement of the gears when burnishing pressure is applied.

The time of burnishing is automatically controlled by adjustable timing relays having a range of from 3 to 40 seconds. These relays are independently adjustable, permitting burnishing longer in one direction than in the other, if such action is desirable.

Owing to the design of this machine and the method of operation employed, it is possible to burnish gears at a rapid rate. A gear of 4-in. diameter, 1/16 in. face width can be handled at the rate of 480 per hour, and smaller gears at a proportionally faster rate. The maximum capacity is 4 in. pitch diameter, 20 diametral pitch.

M-B Adjustable Feed Machine Oiler

The M-B Adjustable Feed Machine Oiler shown in the illustration, product of M-B Products, 130 Larned St. E., Detroit, Michigan, is identical with the M-B Predetermined Feed Machine Oiler which was announced in the August, 1937, issue of MODERN MACHINE SHOP, excepting that the oiler shown here is equipped with means for adjusting the feed of the lubricant. This feature is valuable in cases where the volume of the lubricant varies from time to time.

M-B Adjustable Feed Machine Oiler

The oiler is made to fit pipe sizes ⅛, ¼, and ⅜ in., and is provided in capacities of 1½ oz. and 7 oz.

Procunier Universal Tapping Machine

The line of tapping machines made by the Procunier Safety Chuck Company, 12 S. Clinton St., Chicago, Ill., has been augmented by the addition of the Procunier Universal, illustrated herewith.

ONE WORD
DESCRIPTION OF OUR GREAT LINE OF TWIST DRILLS, REAMERS, HOBS, MILLING CUTTERS Special TOOLS
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By a Quick, Easy, Inexpensive Method
Your business letterhead will bring literature.
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Wilmerding, Pa.

"Buy Economy — You'll Effect Economy"
SOCKET HEAD CAP SCREWS
Milled from Bar
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SAFETY HOLLOW CAP SCREWS
Made of Alloy Steel
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Surface Temperatures

Flat Stationary or Moving Curved Surfaces

The "Alnor" Combination Pyrocon

Ideal for rolls, molds, plates, platens and plastic material temperatures.

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Flush type drives in

and Oil Hole Covers for All Types of Machines and Machine Tools.
Made From Brass Rod With Die Cut Threads. Special Oilers Made To Order.
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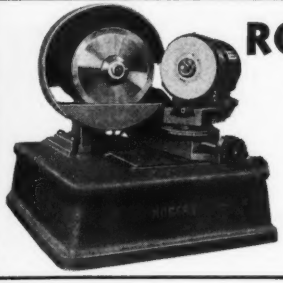
"Established 1899"



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Grind Your Circular Knives at Low Cost

For circular or rotary knives up to 20" diameter. By means of triple slides and swiveling adjustment any degree of bevel can be ground. Graduated dial insures correct bevel angle setting. Unusually low price. Write for Bulletin CC.

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185 DUTTON AVE. BUFFALO, N. Y.
Makers of Knife Grinders For 50 Years

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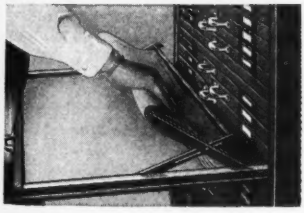

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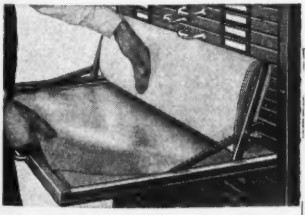

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HAMILTON MANUFACTURING CO.
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Please send me complete information about the Hamilton-Calumet method of filing.

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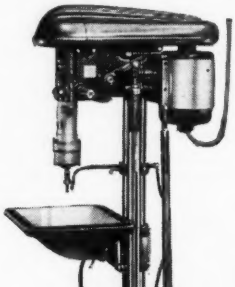
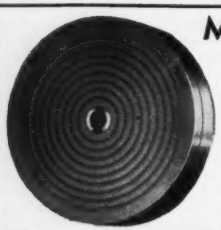
The outstanding feature of this machine is its versatility. The machine is designed to handle an exceptionally wide range of materials and sizes with the maximum production efficiency. The machine has five operating speeds ranging from 365 r.p.m. to 2240 r.p.m. and two interchangeable Procunier Tapping Heads afford a capacity ranging from No. 8 tap to ⅝ in. inclusive.

Pre-set tapping and reversing pressures independent of the operator are maintained by a unique arrangement of helical springs, adjustable over a wide range. This construction facilitates precision tapping at high speeds with maximum protection for taps and work. Continuous lubrication is automatically provided for the tap only while the tap is in operation. Convenient timing and volume adjustments provide for lubrication in the correct volumes as well as for automatically starting the flow at the instant desired.



Procunier Universal Tapping Machine

The Procunier Sensitive High Speed Tapping Head, Tru-Grip Tap Holder, precision hand-screw height adjustment of the working table, precision depth stop adjustment, and offset foot pedal which permits the operator to sit facing the work table are a few of the additional features of this machine. Additional chuck spindles are available for external threading.



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Highest Quality. All Sizes—For All Types of Work. A Complete Line Of Rotary, Rectangular and Swiveling Magnetic Chucks.

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Chicago RAWHIDE HAMMERS

...stop battering, crashing, marring—save machinery and equipment. Weighted Malleable heads give power, balance and accuracy. Coiled Rawhide faces cushion blows. All sizes.

Replaceable insert faces are self-tightening, self-aligning.

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Everyone recognizes "fever" but the important thing is exactly "HOW HOT". It's the same with heat treating, metal melting, and tempering. Guesswork is certain to fail sometime. Know your temperatures. End needless waste, and excessive spoilage with a Hold-Heet Pyrometer.
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Shipped prepaid to rated firms on thirty days approval.

$16 COUPLES
EXTRA 31 to 43
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M-D Facing Heads

With Automatic Feed

Can be attached to Column Boring Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically, and covers faces 6" to 30".

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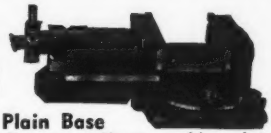

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Double capacity over ordinary machine vises. One piece hand wheel and nut — extra long thread. Hardened tool steel jaws, reversible for V-groove or plain surface. Write for circular. Jaws 6¾" wide . . . 2½" deep . . . open 6¾".

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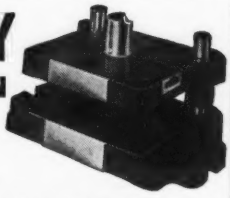

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PRECISION ADJUSTMENTS by simply peeling the paper-thin brass laminations from the **LAMINUM** shim!

Machining, grinding and fitting are saved . . . service adjustments made quickly right at the machine instead of tieing up production.

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Order through your Mill Supply House

Also a complete line of brass and steel thin shim stock, and arbor spacers.

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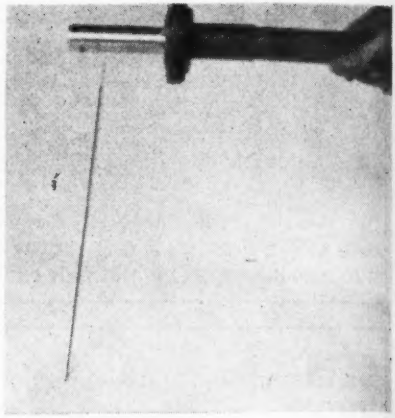
LAMINUM

Precision adjustment SHIMS

Tolman Electrode Holder

Tolman Manufacturing Co., 19 West 3rd St., Boston, Mass., has designed an electrode holder which has no springs, is entirely insulated, is fitted with a fibre handle and with triangular fibre shields which prevent the holder from rolling when at rest. It is said that the holder will not arc when laid on the work without the electrode. Overhead welding can be done without slag dropping into the holder end. The electrode is locked in the holder or as easily released by a few turns of the handle.

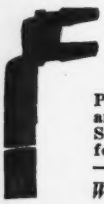


Tolman Electrode Holder

The holder is furnished with or without cable and designed so that the electrode can be inserted either straight or at an angle.

Pyro Bi-Optical Pyrometer

The Pyro "Bi-Optical" Pyrometer, manufactured by The Pyrometer Instrument Co., 103-105 Lafayette St., New York, N. Y., is a patented, combined color pyrometer, whose measuring principle was evolved after years of scientific research and investigation, and developed by this firm into a convenient and handy self-contained instrument for practical purposes. The present invention is based on the use of light filters and color wedges which are transparent to a number of colors simultaneously. By using filters with a number of transparencies both for separation and for mixing and toning down, any compli-



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Play safe! Protect your men and machines. Use the KED-E SAFETY FIRST BELT STICK for moving belts on or off pulleys —cannot get caught.

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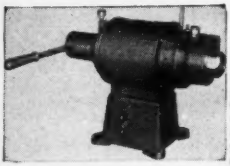

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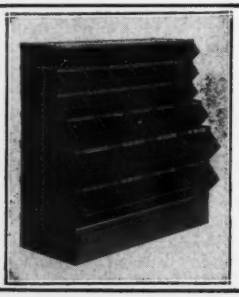

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Assure Peak Production and Lower Maintenance. Rigid and Powerful Bench and Floor Types. Motor or Belt Driven. There is a Linley machine for every riveting job.

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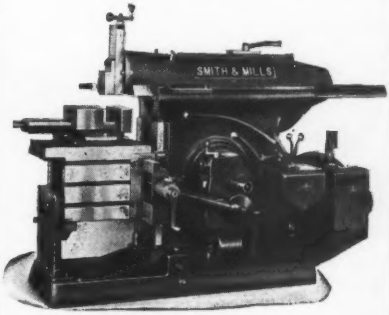

Automatic lubrication—forced feed. Multiple disc clutch and brake. Quick feed changes. Direct reading feed and stroke dials. Power rapid traverse to cross feeds.

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New 6" x 6" Peerless Improved High Duty Metal Sawing Machine With Hydraulically Operated Automatic Bar Feed

Automatically feeds the bar of stock forward to the gauge, automatically closes the vise, and automatically continues to repeat the complete cycle of cutting until the entire bar is cut to the length the gauge is set for, all without the attention of an operator.

The three speed sliding gear transmission—crankshaft—balance lever and trunnion blocks are fully ball bearing equipped. The fastest cutting time possible at a minimum blade cost on any kind of metal because of its modern design and rigid construction.

Also furnished without automatic bar feed.

Also—Peerless Improved Universal Type—Standard Type and Vertical Type in various sizes for fast production sawing.

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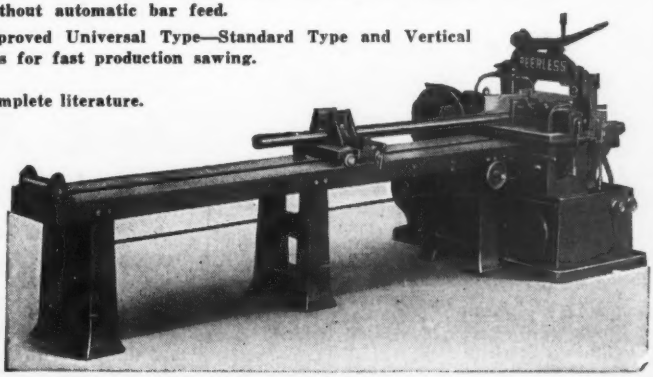

PEERLESS MACHINE COMPANY

RACINE, WISCONSIN

cated optical or mechanical device for the production or combination of colors is rendered superfluous and the creation of a surprisingly simple temperature measuring device in the form of colored discs is rendered possible.

With the "Bi-Optical" pyrometer, the temperature of the "black body" and

Pyro Bi-Optical Pyrometer

the "actual" temperature may be ascertained simultaneously. The instrument is furnished with scale ranges from about 900-1900 deg. C. or 1700-3500 deg. F. This instrument may be used for innumerable laboratory and research applications including incandescent iron and iron alloys in the open and flame heated furnaces, etc. This instrument will be exhibited for the first time at the forthcoming National Metal Exhibition, Atlantic City.

Mid-West Piercing and Drilling Unit

The illustration shows a unit which has been designed by Mid-West Production Engineering Co., Inc., 1421 E. Milwaukee St., Detroit, Mich., to perform both piercing and drilling operations on the metal bowl-shaped parts illustrated in the drawing which can be seen leaning against the front of the machine. The unit was designed to take bowls of three different diameters: 8 in., 10 in. and 12 in. Some of the bowls are pierced only, and some require holes to be drilled in the corner radius as shown in the illustration.

The small holes are 0.085 in. diameter, pierced in 0.107 in. drawn stock. To operate the machine, the operating lever is moved forward, which causes the dies to move out against the work and the four Hydro-Pierce Units to move in and complete the piercing operation. The lever is then reversed upon which the dies move away from the work, the punches are stripped, and the bowls automatically index 9 deg. to the correct position for the machining of the next holes.

He Means **REX-WELD** *the One-Piece Sealed Steam Connection*

● Rex-Weld stands on its record of performance: unlimited flexing life, seep-proof under pressure, non-deteriorating, perfect absorption of vibration or motion of moving parts, take-up of torsion, simplicity of installing and no care after installation—a super-service record made possible by the Rex-Weld new and exclusive process of one-piece balanced strength construction. Get the facts from **Chicago Metal Hose Corporation, Maywood, Illinois (Chicago Suburb).**

ALL ALLOY **PORTABLE SHEARS**

FULLY GUARANTEED

Two Sizes

No. 1 cuts up to No. 11 gauge strip or sheet.
No. 2 cuts up to ¼" steel plate.
Special Blades for shearing stainless steel.

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Good Gears Only

All Kinds
Any Quantity
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DIAMOND TOOLS
(PATENTED)
Our finned and grooved tool saves the diamond from overheating.
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Special Cutters made to Blue Prints
QUALITY TOOL WORKS
Waukegan, Illinois

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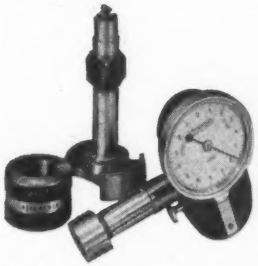
COMTORPLUG



Checks holes to less than 1/10,000"

Users of ball bearings, and other manufacturers requiring highly accurate holes, give their operators and inspectors **COMTORPLUGS.** Shows size, taper, out of round, etc., with accuracy independent of human error.

THE **COMTOR** CO.
Waltham, Mass. Est. 1928

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LAST LONGER

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Thor Stamps are made to give you the most for your money—because they last longer.

Send for booklet.

THE PITTSBURGH STAMP CO.
812 CANAL ST. • PITTSBURGH, PA.

Mid-West Piercing and Drilling Unit

After the piercing operation is completed, the bowls requiring holes in the radius are drilled. Upon movement of a lever at the left of the machine, the four hydraulic drilling units go into action, drilling the required holes. Thus both rows of holes are machined accurately and rapidly with an automatic 9 deg. index, without handling the work until the operation is completed.

Alnor Pyrometer Controller

The Alnor Pyrometer Controller—product of Illinois Testing Laboratories, Inc., 146 W. Austin Ave., Chicago, Ill.—is offered for those who desire to automatically control temperatures of heat treating furnaces, melting pots, or other heating devices at a definite predetermined point. The principle of operation is electronic, similar to the principle of a radio circuit. The pointer of the indicating pyrometer carries a small vane. Opposing the vane is an adjustable target which carries two condensor plates or vanes. These vanes are the capacitive element of a tuned circuit.

Except at the point when the temperature indicating pointer and the target coincide, the circuit is unchanged. When the temperature pointer with its vane approaches the temperature setting, the vanes of the pointer and target interleave and produce a circuit change which in turn operates a relay. The heating element, if electric, is shut off, or in the case of the fuel-fired operation, the fuel valve is closed partially

USE LAYOUT FLUID

for general machine shop and tool room use on dies, jigs, fixtures, and machined parts.
With the use of the die blue layout fluid, you do not have to polish the surface of work. Simply wipe surface fairly clean and brush on. DRIES INSTANTLY.
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GEARS Spur, Worm, Bevel, Helical or Special

WE DO Surface Grinding, Internal and External Grinding, Lapping, Splining and Broaching.
We specialize in grinding hardened steel bushings, cam rollers, etc.
25 years spent in serving the machine trade guarantees quality work and prompt service.
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A fine tool at a reasonable price!

Measures to .001" OUTSIDE, INSIDE and DEPTH
Measuring range 5 5/16". Total length 8".
Scales: 1/16" with vernier 1/128"
.025" with vernier 1/1000"
Decimal equivalents on reverse side of gage.
Glass-hard jaws. Fine workmanship.

The **COMET** Precision **VERNIER CALIPER**
Price $5.50
With genuine leather Pocket Case.
Send for one TODAY!

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Shop agents and dealers wanted.

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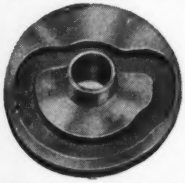

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Select yours at your dealers, or from Free catalog if he does not carry them.

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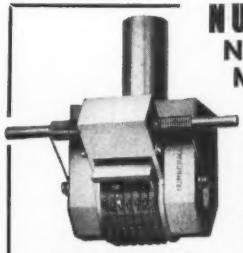

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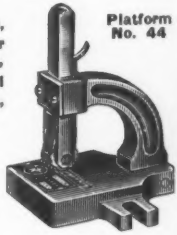

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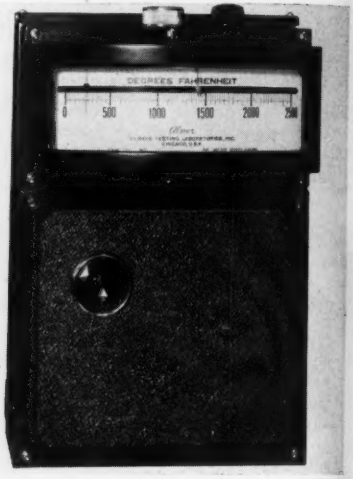

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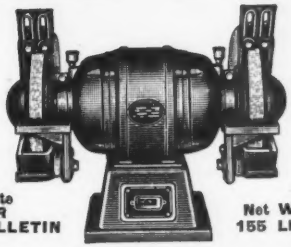

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Link-Belt Book on Power Transmission Pulleys. A new 8-page illustrated list price Book No. 1622 has been completed by Link-Belt Company, Chicago, on the subject of cast iron pulleys for power transmission, giving pertinent data on solid and split, single and multiple arm machine-molded pulleys, with and without rubber lagging.

A copy of the book will be mailed to any interested reader upon request, which may be addressed to the nearest office of the company.

The "Flame-Otrol" is the name given to a gas burner safety device, designed to shut off the gas and prevent explosions in case of flame failure. It effectively safeguards against loss of life, property damage, and tie-up of production schedules. The Flame-Otrol is a product of Wheelco Instruments Co., 1927 S. Halsted St., Chicago, Ill. This company is now issuing an eight-page circular in which the uses of the Flame-Otrol are explained and illustrated. Copy free upon request.

Lignum-Vitae Mallets and Mauls. The complete line of wood mallets and mauls made from Lignum-Vitae, hickory or dogwood by Lignum-Vitae Products Corporation, 100 Boyd Ave., Jersey City, N. J., for the use of metal workers, tinners, stonecutters, foundry workers, boilermakers, coppersmiths, and other mechanics, is described and illustrated in a four-page folder which is now being distributed by the above firm. Specifications and prices are included. Copy free upon request.

Hevi Duty Type MU-55 Multiple Unit Furnace Bulletin. This bulletin, now being issued by Hevi Duty Electric Company, 4212 W. Highland Blvd., Milwaukee, Wis., presents the features of the Type MU-55 Multiple Unit Furnace with controlling pyrometer. This furnace is especially designed for heavy laboratory or light tool room work and is equipped for automatic control of the temperature. This bulletin explains the temperature range, gives details of the construction, and explains the control and operation and voltages. Specifications are included. Copy free upon request.

Gisholt Boring Bars and Reamers. This eight-page bulletin contains complete specifications, prices and descriptions of the boring bars and reamers made by Gisholt Machine Company, 1217 E. Washington Ave., Madison, Wis. Various outstanding features of the tools, such as ample chip clearance, rigid cutter support, and so on, are clearly illustrated by the use of photographs and drawings. The text explains the manner in which ample chip clearance and maximum rigidity are obtained in the boring bar by the use of a patented spiral groove. Solid or adjustable blades may be used in the bars and special bars with several cutters are shown. Various types of Gisholt manufacturing type reamers of the solid adjustable type are illustrated and described. Copy free upon request.

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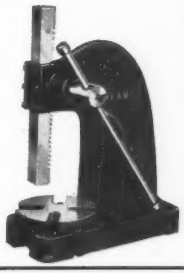

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Janette Bulletin 227. Janette "Precision Built" Generators, Motor Generators, Motorized Speed Reducers, Electric Motors, Blower Wheels, Motorized Blowers, Rotary Converters, and other equipment made by Janette Manufacturing Company, 556 W. Monroe St., Chicago, Ill., are described and illustrated in Bulletin 227 which is now being issued by this firm. Copy free upon request.

Duff-Norton Lifting Jack Catalogue. The Duff-Norton Manufacturing Company, Pittsburgh, Pa., announces the publication of a colorful and well illustrated new catalogue describing their complete line of Lifting Jacks for Mine, Railroad and Industrial Use.

Copies of this handy and informative new catalogue are available by addressing this magazine, or by writing the manufacturer direct.

The Rex World, Vol. 3, No. 1,, presents the Rex conveyor, product of Chain Belt Company, Milwaukee, Wis., in a variety of designs. Two pages of the folder are devoted to photographs and descriptions of Rex conveying equipment in a meat packing house. The use of Rex conveyors and chains in the oil well industry, asphalt industry, coal industry, paper manufacturing, and so on, is also outlined with typical illustrations. Copy free upon request.

Celeron Coupling. Moulded Plastic. A technical bulletin describing the construction, uses, and advantages of the Celeron Moulded Plastic Coupling is now being distributed by the Continental Diamond Fibre Company, Newark, Del. The bulletin particularly features the tests that have been applied to the coupling, in which the steel shaft supporting the coupling was broken without fracturing the coupling in any way. The various features of the coupling are expained and a table of specifications is included. Copy free upon request.

Ingersoll Ray Blade Cutters. The features of standardization and extensive application of the Ingersoll Ray Blade are described in detail in an eight-page circular now being distributed by The Ingersoll Milling Machine Company, Rockford, Ill. Data and prices covering Ingersoll Face Mills, roughing and finishing, medium and heavy duty types, Ray Blade End Mills, Cemented Carbide Cutters, and Core Drills and Reamers, are listed. Information on the assembly and grinding of Ray Blade Cutters is also included. The booklet is well illustrated with photographs and cross-section drawings of the various tools described. Copy free upon request.

Precision Adjustments By Simply Peeling Laminum is the title of a 16-page catalog, in colors, explaining the uses and advantages of the laminated shim brass marketed under the trade name of Laminum by Laminated Shim Company, Inc., 21 44th Ave., Long Island City, N. Y. The text explains how the multiple layers of special-alloy precision-thin shim stock are laminated, with a microscopic layer of metallic binder, into a unit structure from which the laminations can be peeled as required in thickness of either 0.002 or 0.003 in.—or more—at a time. The book is profusely illustrated with pictures of different kinds of mechanical jobs upon which laminated shims are used and drawings are included.

Lee Direct Fired Unit Heater. Industrial buildings require heat for a relatively short time each year and the cost of fuel for line losses and for maintaining steam pressure to prevent freezing is sometimes greater than the cost of the fuel actually delivered as heat. The complexity and high operating cost of steam systems and resulting low efficiency have in the past been largely unavoidable. The ideal heating plant is one that would deliver to the desired locations every heat unit originally contained in the fuel. According to the text matter contained in a catalog which is now being distributed by Dravo Corporation, Machinery Division, Pittsburgh, Pa., the Lee Direct Fired Unit Heater System is a close approach to such an ideal for large buildings such as factories, warehouses, steel plants, garages, and so on.

This catalog contains 20 pages of description of the Lee unit. The text is profusely illustrated with photographs, phantom views, and drawings showing the different types and sizes of units for use under various conditions, and data and specifications are included which will aid the prospective user to select the type which will best fit his needs. Copy of the catalog free upon request.

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Fairbanks-Morse Fig. 5870 Ball Bearing Centrifugal Pumps are illustrated and described in a new Bulletin No. 5870. These compact, sturdy pumps are built especially for operating at high speeds against heads up to 245 ft., with capacities of from 90 to 225 U.S. gallons per minute. Efficiency and compactness are said to make them desirable for installations requiring high pressures and small or moderate capacities, such as in municipal waterworks, industrial plants, golf courses, parks, and so on. Copy free upon request.

National Oil Extractor. This bulletin, now being issued by The Leon J. Barrett Company, Worcester, Mass., lists the salient features of the National Oil Extractor and explains the mechanism by which 98½ per cent of all removable oil can be reclaimed from turnings, borings and chips. Centrifugal force is the principle employed and the outstanding features of the extractor are both rigidity of construction and ease and freedom of operation. The bulletin dwells specifically on the self-contained outboard motor drive, free center pins, antifriction ball bearings, absence of noise and vibration, forced lubrication, standardization of parts, stabilization of the spindle, and safety features. A table of specifications is included. Copy free.

Bulletin T-12 of Technical Information on Monel, Nickel and Nickel Alloys. This bulletin comprises a 14-page discussion of the subject of machining Monel, nickel and Inconel, written by W. F. Burchfield. Mr. Burchfield begins the discussion with a section on the choice of materials and then takes up in turn stock for machining, tool designing, clearance angles, rake, tool steel, heat treatments of tool steels, cutting compounds, cutting-off operations, turning, boring and drilling the metals under discussion, reaming, tapping, lathe threading, thread chasing, planing, milling, and precision grinding.

The center double page consists of a drawing illustrating the correct manner of grinding tools for machining Monel metal, nickel, or "K" metal. All clearance angles, rakes, and so on, are indicated for lathe, planer, and shaper tools, threading tools, boring tools, taps and drills.

Copy of this bulletin can be had by addressing The International Nickel Company, Inc., 67 Wall St., New York, N. Y.

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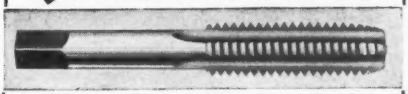

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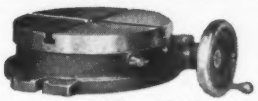

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Westinghouse Motor Driven Welders. Westinghouse Flexarc motor driven welders and bare generators are described in a recent publication. Application, construction, specifications and performance curves for single operator 200, 300 and 400 amperes welders are included. Copies of the publication are available from the nearest district office or direct from Department 5-N, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penn.

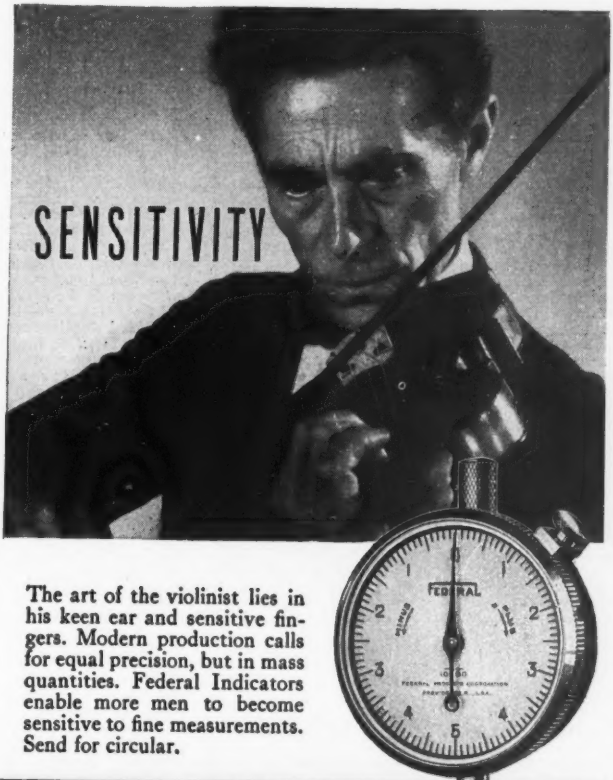
"Magnetic Separator Type 'AM'" Bulletin, issued by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., and detailing the construction and operating characteristics of this specially designed magnetic separator which utilizes AC current for greater pulsating agitation in the treatment of fine dry material. Copy free upon request.

Heat Treatment Fundamentals of Nickel Cast Iron, Plain Cast Iron, Nickel-Chromium Cast Iron and Nickel-Chromium-Molybdenum Cast Iron. Metallurgists working unceasingly to discover new and useful combinations of elements have been no less diligent in efforts to improve structural and mechanical properties of long established materials. As a natural development, metals whose usefulness has heretofore had definite limitations, have had their industrial importance greatly enhanced.

Cast iron is one of the most interesting examples of this trend. Until recent years used primarily for equipment parts of great size requiring little strength, hardness, or resistance to heat, wear and corrosion, its uses are now marked by their diversification. Modern foundry procedure, employing heat treatment, alloying and closer metallurgical control, has done much to assure the improvement of all properties listed and, by improving uniformity of properties and machinability, has decreased rejections by foundry, machine shop and other inspectors.

The improvement of cast iron by heat treatment is discussed in a 16-page bulletin which is now being issued by The International Nickel Company, Inc., 67 Wall St., New York, N. Y. The bulletin takes up in turn the subjects of Critical Ranges of Cast Iron, Critical Cooling Rate, Stress Relief, Effect of Annealing Temperature on the Hardness of Cast Iron, Annealing for Softness, Annealing Semi-Austenitic Irons for Hardness, Quenching, Tempering for Hardness, Quenching Followed by Tempering for Strength, Air Hardening. The last two pages are devoted to a glossary of terms for iron and steel and definitions relating to heat treating operations. The bulletin is well illustrated with photographs and drawings. Copy free upon request.

"The Fable of the Tough Beard and the Dull Razor" is the title of an entertaining booklet on the dressing of grinding wheels, now being distributed by Koebel Diamond Tool Co., 1202 Oakman Blvd., Detroit, Mich. Copy of this "fable in slang" free upon request.



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